Exemplars in Under-5 Mortality: Ethiopia Case Study

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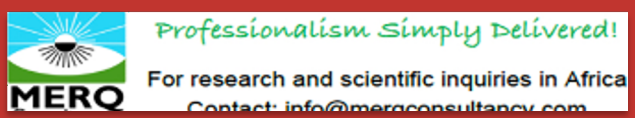


28 February 2020

Table of Contents

LIST OF TABLES **4**
LIST OF FIGURES **6**
ACKNOWLEDGEMENTS **7**
ABBREVIATIONS **8**

1 EXECUTIVE SUMMARY **12**

1.1 Background on Ethiopia 12
1.2 Causes of Under-5 and Neonatal Mortality 13
1.3 Dropping U5M in Ethiopia 13
1.4 Evidence-Based Intervention Implementation: Successes and Challenges 14
1.5 EBI Implementation Strategies 16
1.6 Contextual Factors Including Other Health Interventions 17
1.7 Transferrable Lessons 20

2 INTRODUCTION **21**

2.1 Exemplars in Global Health 21
2.2 Exemplars in Under-5 Mortality 21
2.3 Ethiopia 22

3 METHODS FOR CASE STUDY **39**

3.1 Project Framework 39
3.2 Desk Review 39
3.3 Primary Research 40
3.4 Analysis and Synthesis 41
3.5 Human Subjects Review 41

4 SPECIFIC CAUSES OF DEATH AND EVIDENCE-BASED INTERVENTIONS **42**

4.1 Pneumonia, Diarrhea, and Malaria 43
4.1.1 Facility-Based Integrated Management of Childhood Illness 43
4.1.2 Integrated Community Case Management 49
4.1.3 Other Diarrhea Interventions 56
4.1.4 Other Pneumonia Interventions 66
4.1.5 Other Malaria Interventions 76
4.2 Other Vaccine-Preventable Diseases 83
4.2.1 Measles Vaccination 84
4.2.2 Meningococcal Vaccination 88
4.3 HIV 91
4.3.1 Prevention of Mother-To-Child Transmission of HIV 91
4.3.2 Early Infant Diagnosis and Treatment of HIV 97
4.5 Nutrition 102
4.5.1 Management of Severe Acute Malnutrition 102
4.5.2 Vitamin A 106
4.6 Neonatal Interventions 109
4.6.1 Improving Antenatal Care Services, Access, and Uptake 109
4.6.2 Improving Childbirth Delivery Services, Access, and Uptake 119
4.6.3 Improving Post-Partum Care 141
4.7 Regional variability and equity gaps for Disease Rates and EBI Coverage 155
4.8 Common Implementation Strategies 156

5 CROSS-CUTTING CONTEXTUAL FACTORS (FACILITATORS AND BARRIERS) 158

5.1 Effective National Leadership and Control: Setting Clear Goals and Priorities (facilitator) 158
5.2 Donor and Implementing Partner Resources (facilitator) 159
5.3 Economic Growth (facilitator) 160
5.4 Investment in Health (facilitator) 160
5.5 Strong Community Health System (facilitator) 161
5.6 Ongoing Health Systems Strengthening Efforts 161
5.7 Data Availability and Use (facilitator) 162
5.8 Rising Private Health Sector (facilitator) 163
5.9 Supply Chain (barrier) 163
5.10 Conflict (barrier) 163
5.11 Geography and Inequity of Coverage Across Regions (barrier) 163
5.12 Climate (barrier) 165
5.13 Low Utilization of Health Services (barrier) 165
5.14 Pastoralist Culture (barrier) 165
5.15 Women's Empowerment (facilitator and barrier) 166
5.16 Poverty Reduction Efforts (facilitator) 166
5.17 Nutrition Programming (facilitator) 167
5.18 Water, Sanitation, and Hygiene (WASH) Improvement (facilitator) 168

6 TRANSFERRABLE KNOWLEDGE FOR OTHER COUNTRIES 169
7 CONCLUSIONS 171

REFERENCES 172
APPENDIX A 172

List of Tables

Table 1: Coverage of Selected EBIs in Ethiopia, 2000-2016 (Source: DHS) 15
Table 1: Under-5 and Neonatal Mortality Rates (Per 1,000 Live Births) by Region (Source: DHS) 26
Table 3: Total Numbers and Density of Key Health Worker Categories in Ethiopia, 2009 31
Table 4: Distribution of Physicians, Nurses, Midwives, and HEWs Across Regions and City Administrations of Ethiopia, 2009. 31
Table 5: Health Extension Program Services Package (2014)[31] 32
Table 6: Population to HEW Ratio by Region, 2009/10[31] 35
Table 7: Causes of Death in Ethiopia Per 100,000 of Population Under 5 (Source: IHME) 42
Table 8: Causes of Death in Ethiopia Per 100,000 of Neonatal Population (Source: IHME) 42
Table 9: Facility-Based IMCI Key Implementation Strategies 43
Table 10: Care -seeking at Facility for Children Under 5 by Region, 2016 (Source: DHS 2016) 46
Table 11: Facility-Based IMCI Implementation Strategy and Outcomes 48
Table 12: Integrated Community Case Management Key Implementation Strategies 49
Table 13: iCCM implementation strategies 55
Table 14: ORT and Zinc Key Implementation Strategies 56
Table 15: Oral Rehydration Therapy and Zinc Implementation Strategies and Outcomes 59
Table 16: Rotavirus Vaccination Key Implementation Strategies 60
Table 17: Rotavirus Vaccination Implementation Strategies and Outcomes 64
Table 18: Pneumococcal Vaccination Key Implementation Strategies 66
Table 19: PCV Implementation Strategies and Outcomes 69
Table 20: Hib Vaccination Key Implementation Strategies 71
Table 21: Hib Vaccine Implementation Strategies and Outcomes 75
Table 22: ITN Key Implementation Strategies 76
Table 23: ITN Implementation Strategies and Outcomes 79
Table 24: IRS Key Implementation Strategies 80
Table 25: IRS Implementation Strategies and Outcomes 82
Table 26: Other Vaccine-Preventable Diseases Key Implementation Strategies 83
Table 27: Measles Vaccination Unique Implementation Strategies 84
Table 28: Measles Vaccine Implementation Strategies and Outcomes 87
Table 29: Meningococcal Vaccination Unique Implementation Strategies 88
Table 30: Meningococcal Vaccination Implementation Strategies and Outcomes 90
Table 31: HIV Program Key Implementation Strategies 91
Table 32: PMTCT Unique Implementation Strategies 91
Table 33: PMTCT Implementation Strategies and Outcomes 96
Table 34: Infant Diagnosis and Pediatric HIV Treatment: Key Implementation Strategies 97
Table 35: Early Infant Diagnosis and Treatment of HIV Implementation Strategies and Outcomes 101
Table 36: Management of SAM Key Implementation Strategies 102
Table 37: Management of SAM Implementation Strategies and Outcomes 105
Table 38: Vitamin A Key Implementation Strategies 106
Table 39: Vitamin A Implementation Strategies and Outcomes 108
Table 40: ANC Key Implementation Strategies 109
Table 41: ANC Implementation Strategies and Outcomes 112
Table 42: Management of Hypertensive Disorders Key Implementation Strategies 113
Table 43: Management of Hypertensive Disorder Implementation Strategies and Outcomes 115
Table 44: Maternal Tetanus Vaccination Key Implementation Strategies 116

Table 45: Maternal Tetanus Vaccination Implementation Strategies and Outcomes 118
Table 46: Facility-Based Delivery and Skilled Birth Attendance Implementation Strategies 119
Table 47: FBD and SBA Implementation Strategies and Outcomes 124
Table 48: BEmONC and CEmONC Key Implementation Strategies 125
Table 49: BEmONC and CEmONC Implementation Strategies and Outcomes 128
Table 50: Caesarean Section Key Implementation Strategies 129
Table 51: Caesarean Section Implementation Strategies and Outcomes 131
Table 52: Clean Delivery Practices Key Implementation Strategies 132
Table 53: Clean Delivery Implementation Strategies and Outcomes 135
Table 54: Corticosteroids Key Implementation Strategies 136
Table 55: Corticosteroids Implementation Strategies and Outcomes 138
Table 56: Active Management of Delivery Key Implementation Strategies 138
Table 57: Active Management of Delivery Implementation Strategies and Outcomes 140
Table 58: Neonatal Resuscitation Key Implementation Strategies 141
Table 59: Neonatal Resuscitation Implementation Strategies and Outcomes 143
Table 60: NICUs Key Implementation Strategies 144
Table 61: NICUs Implementation Strategies and Outcomes 146
Table 62: KMC Key Implementation Strategies 147
Table 63: KMC Implementation Strategies and Outcomes 149
Table 64: Management of Neonatal Sepsis Key Implementation Strategies 150
Table 65: Management of Neonatal Sepsis Implementation Strategies and Outcomes 152
Table 66: Post-Partum Visits Key Implementation Strategies 152
Table 67: Post-Partum Visits Implementation Strategies and Outcomes 154
Table 68: Contextual Factors 158
Table 69: Infant and Child Under-5 Mortality Evidence-Based Interventions 188
Table 70: Neonatal Mortality Evidence-Based Interventions 189

List of Figures

Figure 1: Equity Analysis of Under-5 Mortality Rate in Ethiopia (Source: Victora et al, 2018) 20
Figure 2: Equity Analysis of Neonatal Mortality Rate in Ethiopia (Source: Victora et al, 2018) 20
Figure 3: Map of Ethiopia (Source: ReliefWeb) 22
Figure 4: Pastoralist Areas of Ethiopia (Source: OpenLearn Create) 23
Figure 5: Under-5 Mortality Rate (per 1,000 live births) in Ethiopia (Source: DHS 2000, 2005, 2010, 2016) 25
Figure 6: Equity Analysis of Under-5 Mortality Rate in Ethiopia (Source: Victora et al, 2018) 25
Figure 7: Map of Ethiopia Showing Trend of Under-5 Mortality, 2000-2016 (Source: IHME 2018) 26
Figure 8: Map of Ethiopia Showing Trend of Neonatal Mortality, 2000-2016 (Source: IHME 2018) 27
Figure 9: Neonatal Mortality Rate in Ethiopia (Source: DHS 2000, 2005, 2010, 2016) 27
Figure 10: Equity Analysis of Neonatal Mortality Rate in Ethiopia (Source: Victoria, et al 2018) 27
Figure 11: Relative reduction in U5M and NMR in the best and least performing regions in reducing U5M, Ethiopia (Source: DHS 2000 and 2016) 28
Figure 12: Ethiopia's Three-Tier Health System (Source: Teklu, 2019) 28
Figure 13: Facilities Providing Selected Basic Health Services in Ethiopia in 2014 (Source: ESPA+ 2014) 30
Figure 14: Evolution of the Health Extension Service Package[36] 34
Figure 15: Health Expenditure Per Capita in Ethiopia (2000-2015) 37
Figure 16: Domestic Expenditure as % of Total Health Expenditure in Ethiopia (2000-2015) 38
Figure 17: Composite Coverage Index in Ethiopia by Wealth and Year (Source: Victora et al, Countdown 2030 Equity Profile) 38
Figure 18: Care-seeking at Facility for Children Under 5, 2000-2016 (Source: DHS 2000, 2005, 2011, 2016) 45
Figure 19: Equity of Care-Seeking for Diarrhea 2000-2016 (Source: Victoria et al, 2018) 46
Figure 20: Equity of Care-Seeking for Fever 2000-2016 (Source: Victoria et al, 2018) 46
Figure 21: Equity of Care-Seeking for Pneumonia 2000-2016 (Source: Victoria et al, 2018) 46
Figure 22: WHO/UNICEF Estimated Immunization Coverage in Ethiopia, 2014-2015 63
Figure 23: Penta3 Immunization Coverage Estimated by FMOH, WHO/UNICEF and DHS (2008-2016) 73
Figure 24: Measles Immunization Estimated Coverage, Compared with DPT3 (2006-2016) 86
Figure 25: Meningococcal A Vaccine Campaign Targeted Areas by Phase, Ethiopia (2013-2015) 89
Figure 26: Receipt of Any ANC from Skilled Provider by Residence Type and Location, 2016 (Source: DHS 2016) 111
Figure 27: Equity and Coverage Outcome in Wealth Quintiles - ANC (at Least One Visit) (2000-2016) (Source: Victora et al 2018) 111
Figure 28: Equity and Coverage Outcome in Wealth Quintiles - ANC4+ (2000-2016) (Source: Victora et al, 2018) 111
Figure 29: Live Births Delivered at Health Facilities in Ethiopia (2000-2016) (Source: DHS) 123
Figure 30: Live Births Delivered at Health Facilities in Ethiopia by Region/City Administration, 2016 (Source: DHS) 123
Figure 31: Equity Analysis of Institutional Delivery in Ethiopia, 2000-2016 (Source: Victora et al, 2018) 123
Figure 32: Under-5 Mortality in Ethiopia by Region/City Administration, 2000 and 2016 (Source: DHS) 164
Figure 33: EPIS model of implementation (Source: Aarons, et al) 190
Figure 34: Types of outcomes in implementation research (Source: Proctor, et al) 191
Figure 35: Framework for understanding interventions to reduce under-5 mortality (copyright UGHE) 192

Acknowledgements

We would like to acknowledge the following groups for their support throughout the research and development of this case study:

- Gates Ventures (formerly bgC3) and the Bill & Melinda Gates Foundation for oversight and funding support;
- The Institute for Health Metrics and Evaluation and Simon Hay's team for creation of Local Burden of Disease under-5 and neonatal mortality rate maps;
- Cesar Victora and his team at the International Center for Equity in Health, Federal University of Pelotas, Brazil for equity analyses;
- Evaluserve for initial desk review development; and
- National and subnational level stakeholders, for providing valuable insight;
- MERQ Consultancy PLC, for serving as the local institution for facilitation of logistics and regulatory requirements.

Abbreviations

ACS:	Antenatal Corticosteroids
ACT:	Artemisinin-based Combination Therapy
AIRS:	Africa Indoor Residual Spraying
AMTSL:	Active Management of Third Stage of Labour
ANC4+:	4 or more Antenatal Care Visits
ANC:	Antenatal Care
ARI:	Acute Respiratory Infection
ART:	Antiretroviral Therapy
ARV:	Antiretroviral
BCG:	Bacillus Calmette–Guérin
BEmONC:	Basic Emergency obstetric and Newborn Care
BIS:	BEmONC implementation strength
CBHI:	Community-Based Health Insurance
CBNC:	Community-Based Newborn Care
CD4:	Cluster of Differentiation 4
CDC:	Centers for Disease Control and Prevention
CEmONC:	Comprehensive Emergency Obstetric and Newborn Care
CHAI:	Clinton Health Access Initiative
CHW:	Community Health Worker
cIMCI:	Community Integrated Management of Childhood Illness
CMAM:	Community-based management of acute malnutrition
cMYP:	Comprehensive Multi-Year Plan
COD:	Cause of Death
C-section:	Caesarean Section
DDT:	Dichlorodiphenyltrichloroethane
DHS:	Demographic and Health Survey
DNA PCR:	Deoxyribonucleic Acid Polymerase Chain Reaction
DPT:	Diphtheria, Pertussis and Tetanus
DTwP:	Diphtheria, Tetanus toxoids and whole-cell Pertussis vaccine
EBI:	Evidence-Based Intervention
EmOC:	Emergency Obstetric Care
EmONC:	Emergency Obstetric and Newborn Care
ENHAT-CS:	Ethiopia Network for HIV/AIDS Treatment, Care, and Support
EOS:	Enhanced Outreach Strategy
EPI:	Expanded Program on Immunization
EPIAS:	Exploration, Preparation, Implementation, Adaptation, and Sustainment
EPIS:	Exploration, Preparation, Implementation, and Sustainment
ESPA+:	Ethiopian Service Provision Assessment Plus
FB-IMCI:	Facility-Based Integrated Management of Childhood Illness

FMOH:	Federal Ministry of Health
FTC:	Farmer Training Center
FY:	Fiscal Year
GAVI:	Global Alliance for Vaccines and Immunization
GDP:	Gross Domestic Product
GFATM:	Global Fund to Fight AIDS, Tuberculosis, and Malaria
HBB:	Helping Babies Breathe
HCT:	HIV Counseling & Testing
HCW:	Health Care Worker
HDA:	Health Development Army
HDI:	Human Development Index
HEAT:	Health Education and Training
HEP:	Health Extension Program
HepB:	Hepatitis B
HEW:	Health Extension Workers
Hib:	Haemophilus influenzae type B
HIV:	Human Immunodeficiency Virus
HIV/AIDS:	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HIV+:	Positive Human Immunodeficiency Virus
HMIS:	Health Management Information System
HR:	Human Resource
HRH:	Human Resources for Health
HSDP:	Health Sector Development Programme
HSS:	Health System Strengthening
HSSP:	Health Sector Strategic Plan
HSTP:	Health Sector Transformation Plan
ICAP:	International Center for AIDS Care and Treatment Programs
iCCM:	Integrated Community Case Management
ICM:	International Confederation of Midwives
ICM/FIGO:	International Confederation of Midwives/ International Federation of Gynecology & Obstetrics
IEC:	Information, Education, and Communication
IESO:	Integrated Emergency Surgical Officer
IFHP:	Integrated Family Health Program
IHME:	Institute of Health Metrics and Evaluation
IMCI:	Integrated Management of Childhood Illness
IMNCI:	Integrated Management of Neonatal and Childhood Illness
IPTp:	Intermittent preventive treatment in pregnancy
IRB:	Institutional Review Board
IRS:	Indoor Residual Spraying
ITN:	Insecticide-Treated Net
JSI:	John Snow Inc

KI:	Key Informant
KII:	Key Informant Interviewee
KMC:	Kangaroo Mother Care
L10K:	Last Ten Kilometers
LLIN:	Long-Lasting Insecticidal Net
LMIC:	Low- and Middle-Income Country
M&E:	Monitoring and Evaluation
MBB:	Marginal Budgeting for Bottlenecks
MCH:	Maternal and Child Health
MCV:	Measles-Containing Vaccine
MDG:	Millennium Development Goal
MenAfriVac:	Meningococcal Group A Conjugate Vaccine
MERQ:	Monitoring, Evaluation, Research, Training and Quality Improvement
MIS:	Malaria Indicator Survey
MNCH:	Maternal, Newborn and Child Health
MNCH-CBNC:	Maternal Newborn and Child Health-Community-Based Newborn Care
MOH:	Ministry of Health
MSG:	Mothers' Support Group
MTCT:	Mother-to-child transmission
NGO:	Non-Governmental Organization
NICU:	Neonatal Intensive Care Unit
NMR:	Neonatal Mortality Rate
OOP:	Out-of-Pocket
ORS:	Oral Rehydration Salt
ORT:	Oral Rehydration Therapy
OTP:	Outpatient Therapeutic Program
PATH:	Program for Appropriate Technology in Health
PCV:	Pneumococcal Conjugate Vaccine
PEPFAR:	President's Emergency Plan For AIDS Relief
PFSA:	Pharmaceutical Fund and Supply Agency
PHC:	Primary Health Care
PMI:	President's Malaria Initiative
PMTCT:	Prevention of Mother-To-Child Transmission
PNC:	Postnatal Care
Q1:	Wealth Quintile 1 (Lowest or Poorest)
Q5:	Wealth Quintile 5 (highest or wealthiest)
RDT:	Rapid Diagnostic Testing
RHB:	Regional Health Bureau
RHF:	Recommended Home Fluids
RI:	Respiratory Infection
RTV:	Rotavirus Vaccine

RUTF:	Ready-to-Use Therapeutic Food
SaLTS:	Saving Lives Through Safe Surgery
SAM:	Severe Acute Malnutrition
SARA:	Service Availability and Readiness Assessment
SBA:	Skillled Birth Attendant
SDG:	Sustainable Development Goal
SIA:	Supplementary Immunization Activities
SNNP:	Southern Nations, Nationalities, and Peoples
SNNPR:	Southern Nations, Nationalities, and Peoples' Region
SPA:	Service Provision Assessment
START:	Strategic Analysis, Research, & Training
STI:	Sexually Transmitted Infection
TB:	Tuberculosis
TFC:	Therapeutic Feeding Center
TFP:	Therapeutic Feeding Program
TFU:	Therapeutic Feeding Unit
TOT:	Training of Trainers
TT2:	Two doses of Tetanus Toxoid
TWG:	Technical Working Group
U5:	Under-5
U5M:	Under-5 Mortality
UGHE:	University of Global Health Equity
UHC:	Universal Health Coverage
UN:	United Nations
UNAIDS:	Joint United Nations Programme on HIV and AIDS
UNFPA:	United Nations Fund for Population Activities (United Nations Population Fund)
UNICEF:	United Nations Children's Fund
USAID:	United States Agency for International Development
USD:	United States Dollar
VCT:	Voluntary Counseling and Testing
WASH:	Water, Sanitation, and Hygiene
WDG:	Women Development Groups
WHO AFRO:	World Health Organization African Regional Office
WHO:	World Health Organization

1 Executive Summary

1.1 Background on Ethiopia

Ethiopia is a large (426,400 mi^2), landlocked country located in the Horn of Africa. With a population of just over 110 million, Ethiopia is the second most populous country in Africa. While urbanization is increasing, 81% of the population currently lives in rural areas, which have substantially lower standards of living than urban areas.

Ethiopia has the fastest growing economy in Africa, growing by an average of 10.3% per year from 2006/07 to 2016/17, compared to a regional average rate of growth of 5.4%. Its Gross Domestic Product (GDP) grew from $8.24 billion in 2000 to $64.47 billion United States Dollars (USD) in 2015.This economic growth has led to a reduction of poverty (measured by the proportion of the population living below $1.90 a day) in the country, from 38.7% in 2004 to 23.5% in 2015. However, regional differences in poverty persist – in 2011, the poverty headcount ratio based on the national poverty line ranged from 11.1% in Harari to 36.1% in Afar. Ethiopia's human development index (HDI) has also improved over the study period, increasing from 0.283 in 2000 to 0.451 in 2015. Despite this improvement, Ethiopia remains one of the poorest countries in the world with a GDP per capita of $645.47 in 2015.

In addition, Ethiopia has faced challenges due to conflict over disputed land on the Ethiopian-Eritrean border of the Tigray and Afar regions, which led to a state of war between the two countries beginning in 1998. In addition to an estimated 70,000 total casualties on both sides, both countries experienced massive displacement of civilians and exacerbated economic problems, leading to food shortages. This has impacted under-5 mortality (U5M) and is explained in more detail below. In July 2018, after the conclusion of the study period, the leaders of both countries signed a joint declaration formally ending the state of war.

Ethiopia is also an extremely ethnically diverse country consisting of more than 90 distinct ethnic groups who speak over 80 languages. Per the most recent (2007) national census, the largest ethnic groups in Ethiopia are the Oromo and Amhara, who make up 34% and 27% of the country's population, respectively. The most common religions in Ethiopia are Ethiopian Orthodox Christianity (44%) and Islam (35%).

Pastoralist areas make up two-thirds of all land in Ethiopia (see Figure 4). The pastoralist population of an estimated 10-12 million people live in several regions of the country. The large majority of pastoralists live in the Somali (53%) and Afar (29%) regions, though pastoralism also exists in Tigray, Benishangul-Gumuz, and Gambella. These differences in population characteristics are an important contextual factor in Ethiopia's work to expand evidence-based interventions (EBI) and reduce U5M.

1.2 Causes of Under-5 and Neonatal Mortality

Between 2000 and 2015/16, Ethiopia dropped its U5M from 166 per 1,000 live births in 2000 to 67 per 1,000 live births in 2016, with the fastest rate of reduction in U5M in this period (5% annually) compared to countries with similar economic status bordering Ethiopia, including Kenya (1.5%), Sudan (2.2%), and Djibouti (2.3%). While the rate was still high (for example, Kenya was 47/1000 live births in 2016), this progress in U5M spanned wealth quintiles (from 159 per 1,000 live births among the poorest and 148 per 1,000 live births among the richest in 2000 to 89 per 1,000 live births among the poorest and 66 per 1,000 live births among the richest in 2016), though the equity gap remained. The actual declines in some regions was also remarkable: Gambella fell from 233/1000 live births to 88 and Somali from 184 to 94 deaths/1000 live births. Ethiopia also dropped their neonatal mortality rate (NMR) although at a slower rate from 97 per 1,000 live births in 2000 to 48 per 1,000 live births in 2016. However again they outperformed the surrounding countries in their drop in NMR.

The top causes of death (CODs) in the under-5 (U5) population older than one month were respiratory infection (RI) and diarrheal disease in 2016. Within the case study period, the rate of RI dropped from 488.9 per 100,000 children under 5 in 2000 to 160.4 per 100,000 children under 5 in 2016 (67% decline). Diarrheal-related mortality rates fell from 423.8 in 2000 to 191.4 in 2016 (54.8% reduction). The rates for the nation's next three most common causes of U5M, measles, malnutrition, and meningitis also declined, from 384.1 in 2000 to 69.9 for measles, from 211.6 per 100,000 children under 5 to 56.5 for malnutrition, 112.8 to 38.3 for meningitis. Two other conditions that figured significantly in Ethiopia's 2000 U5M profile – malaria and Human Immunodeficiency Virus (HIV) – both declined substantially, with the malaria death rate falling by 92% and the HIV death rate by 90% between 2000 and 2016.

The top three CODs in the early neonatal (0-7 days) population in Ethiopia were preterm birth, birth asphyxia, and birth trauma. Early NMRs of birth asphyxia and birth trauma (combined statistics via Institute of Health Metrics and Evaluation, IHME) declined from 57,878/100,000 live births in 2000 to 38,562/100,000 in 2016, while mortality caused by preterm birth improved from 40,629/100,000 to 20,601/100,000. In late neonates (7-28 days), the top three CODs at the start of the study period were RIs, sepsis and other neonatal infections, and birth asphyxia and birth trauma. Late neonatal mortality due to RIs decreased from 13,024/100,000 in 2000 to 6,178/100,000 in 2016 and deaths caused by sepsis and other neonatal infections declined from 2,637/100,000 to 2,352/100,000. Mortality due to birth asphyxia and birth trauma also improved in the late neonate population, from 2,043/100,000 in 2000 to 711/100,000 in 2016.

1.3 Dropping U5M in Ethiopia

The success of Ethiopia represents a combination of the implementation and expansion of many EBIs known to prevent or reduce the mortality from the most common CODs as well as broader contextual factors that aided U5M indirectly and improved resilience and facilitation of EBI implementation. These included health systems strengthening through improved human resources (HR), and water, sanitation, and hygiene (WASH), nutrition, and pro-poor interventions. Broadly, other contextual factors such as availability of donor and partner resources, strong intersectoral collaboration, improvement in women's

literacy, and some success in strengthening baseline low levels of women's empowerment in addition to rapid economic growth in the country were also important facilitators of U5M reduction.

National policies and programs increased the resilience of individuals and families through reduced poverty and improved nutritional status (reduction in stunting). Ethiopia also achieved notable progress in WASH during the study period, with improvement in both open defecation and access to improved water sources, a key contributor to reduction of incidence of diarrhea and contributing to mortality from diarrhea in children under 5.

1.4 Evidence-Based Intervention Implementation: Successes and Challenges

Ethiopia implemented most of the prevention and curative EBIs known to address the leading and other CODs for U5 in Ethiopia. These included vaccinations, treatment of malaria, diarrhea, and pneumonia, as well as prevention of malaria and reducing neonatal mortality through improving care in the antenatal, perinatal, and postnatal periods. Most of the EBIs in 2000 had extremely low coverage rates such as health facility delivery (5%), four or more antenatal care (ANC4+) visits (10.4%), measles vaccination (27%), and care-seeking for diarrhea (14.2%). While there was an improvement in coverage of many of these EBIs, contributing to the reduction in U5M, the success in reaching all and achieving equity was mixed. This was particularly evident for the pastoralist regions (Afar and Somali), rural vs. urban areas, and more broadly wealth inequities, all of which are described in more detail below.

Ethiopia was successful in achieving coverage in a number of EBIs which included vaccinations such as pentavalent and rotavirus vaccine (RTV) and elimination of neonatal tetanus through vaccination of women of childbearing age. However, even within high national coverage, geographic disparities remained in coverage of the pentavalent vaccination, ranging from 90% in Addis to 20% in Afar. In contrast to pentavalent, measles vaccination only increased from 27% to 54% nationally, remaining overall below the universal levels (90-95%) needed to move to elimination of measles. Disparities in measles persisted, with rates ranging from 30% in Afar to 93% in Addis.

Others EBIs saw significant improvement despite not achieving near national coverage. Implementation of Facility-Based Integrated Management of Childhood Illness (FB-IMCI) and Community-Delivered IMCI (Community-Integrated Management of Childhood Illness, cIMCI, or Integrated Community Case Management, iCCM) was completed at the national level. Care-seeking improved throughout the study period, with care-seeking for ARIs increasing from 18% in 2000 to 34.1% in 2016 and receipt of treatment increasing from 3.9% in 2000 to 22.9% in 2016. Oral rehydration therapy (oral rehydration salt, ORS, and zinc) for diarrhea improved from 19% in 2000 to 38% in 2016.

As mentioned previously, facility-based delivery was very low at the beginning of the study period, but increased nationally from 5% in 2000 to 26.2% in 2016, though rates are still well below national coverage. Rates were especially low in Afar (increasing from 4.1% in 2000 to 15% in 2016) and Somali (5.6% to 18%). This was due to a combination of resistance to facility-based delivery as well as challenges with quality of care which also contributed to women choosing to deliver at home.

Other EBIs which focused on reducing deaths in this age group not mentioned above include:

- Pneumococcal and meningococcal vaccinations
- Malaria interventions (insecticide-treated nets [ITNs] and indoor residual spraying [IRS] vaccine, intermittent treatment of malaria during pregnancy)
- HIV Interventions (Prevention of Mother-to-Child Transmission [PMTCT] and early infant diagnosis and treatment of HIV)
- Management of severe acute malnutrition (SAM)
- Vitamin A distribution
- Neonatal interventions (ANC4+), management of pregnancy associated hypertensive disorders, basic and comprehensive obstetric and newborn care (BEmONC and CEmONC), Caesarean section, clean delivery strategies, corticosteroids for active labor, partograph use, neonatal resuscitation, Neonatal Intensive Care Units (NICUs) and Kangaroo Mother Care (KMC), management of neonatal sepsis and post-partum visits

Table 1: Coverage of Selected EBIs in Ethiopia, 2000-2016 (Source: DHS)

U5 Cause of Death	Intervention	2000	2005	2011	2016
Acute Respiratory Infections	Children with symptoms of acute respiratory infection (ARI) taken to health facility	18.0%	20.9%	30.9%	34.0%
	Children with symptoms of ARI who received antibiotics	-	3.4%	8.1%	22.9%
	Vaccination: 3 doses of Pneumococcal Conjugate Vaccine (PCV)	-	-	-	49%
	Vaccination: 3 doses of DPT/pentavalent vaccine	-	-	-	53%
	U5 with symptoms of ARI – 2 weeks preceding survey	*24.4%*	*12.6%*	*7.0%*	*6.6%*
Diarrheal Diseases	Oral rehydration therapy (either ORS or RHF)	19.1%	27.3%	29.6%	38.1%
	Vaccination: 2 doses of rotavirus	-	-	-	56%
	Children with diarrhea taken to health facility	14.2%	21.6%	31.8%	46.3%
	U5 with diarrhea – 2 weeks preceding survey	*23.6%*	*18.0%*	*13.4%*	*11.8%*
Malaria	Household ownership of ITN	-	3.4%	-	-
	Proportion of children under 5 who slept under ITN on night prior to survey	-	1.5%	-	-
	Advice or treatment of fever sought from a health facility or provider	20.4%	18.3%	25.6%	36.4%
	Treatment of children with fever with antimalarial drugs	3.0%	3.7%	3.6%	7.7%
	U5 with fever – 2 weeks preceding survey	*28.4%*	*18.7%*	*17.1%*	*14.3%*
Measles	Measles vaccination coverage	26.6%	24.9%	55.7%	54.3%
Malnutrition	Exclusive breastfeeding from 0-5 months	54.5%	-	52.0%	57.5%
	U5 receiving vitamin A supplements in the six months preceding survey	-	-	53.1%	44.7%

	U5 stunted	57.7%	50.8%	44.4%	38.4%
	U5 wasted	12.2%	12.2%	9.7%	9.8%
HIV	HIV counseling during ANC visit %	-	-	13.6%	23.3%
	HIV testing during ANC or labor and results received	-	-	20.0%	34.3%
Other vaccine preventable diseases	Full vaccination coverage with 3 doses DPT, 3 doses polio, measles, and BCG	14.3%	20.4%	24.3%	38.5%
Neonatal CODs	Total fertility rate (15-49)	5.5	5.4	4.8	4.6
	Antenatal care: 4+ visits by a skilled provider	10.4%	12.2%	19.1%	31.8%
	Vaccination: Tetanus protection at birth	-	-	48.3%	49.0%
	Delivery in a health facility	5.0%	5.3%	9.9%	26.2%
	Delivery attended by skilled provider	-	-	10.8%	27.7%
	Delivery by C-section	0.7%	1.0%	1.5%	1.9%
	PNC: Postnatal visit for baby within 2 days of birth	-	-	-	13.1
	PNC: Postnatal visit for mother within 2 days of birth	-	-	6.7%	16.5%
	Median birth interval (months)	33.6	33.8	33.9	34.5
	Teenagers who have begun childbearing	16.3%	16.6%	12.4%	12.5%

1.5 EBI Implementation Strategies

In implementing the EBIs, Ethiopia utilized a variety of cross-cutting implementation strategies which supported the work, although as noted above not all were successful. The most common implementation strategies were:

1. National leadership and accountability including financial commitments for addressing U5
2. Integration of EBIs into national policy development and planning community engagement and education
3. Donor coordination and engagement and leveraging expertise and resources
4. Data use for decision-making (e.g. using global evidence, monitoring and evaluation, data use for adaptation and prioritization)
5. Small-scale testing and rapid scale-up
6. Stakeholder engagement including community engagement
7. Decentralization of service delivery including into the community through outreach/community-based delivery
8. Focus on equity
9. Leveraging and integration into existing systems, especially the Health Extension Program (HEP)
10. Free service delivery for some areas (e.g. immunization)
11. HR strengthening (e.g. training, supportive supervision, mentoring)
12. HR task shifting largely to health extension workers (HEW)
13. Systems strengthening

In particular, strategies that were identified as most critical in EBI implementation were the national role of government including national policy and development planning, leveraging and coordinated strong donor and partner support, and a commitment to using data for evidence-based decision-making. The approach to health systems strengthening (HSS) was also critical leveraging and integration into existing systems. The existing HEW Program was particularly important in implementing EBIs targeting U5M to ensure acceptability, reach, and feasibility, although again, it was not universally successful particularly in the pastoralist areas and in expanding facility-based delivery. This program focused on decentralizing resources to increasing health posts and community health workers (HEWs), especially in pastoralist and rural areas. HEWs were crucial in the implementation of EBIs at the community level (with varying success) including iCCM, routine vaccines, antenatal care (ANC), facility-based delivery, postpartum services, and ITN.

1.6 Contextual Factors Including Other Health Interventions

As noted previously, the varied success in achieving coverage and equity of U5M-specific EBIs suggests that diverse contextual factors (discussed below) including broader public health interventions played a role in U5M reduction. These interventions include nutrition programming, WASH, and policies addressing factors associated with U5M such as access to reproductive health, female empowerment, and economic development.

For nutrition, stunting, a risk factor for U5M, improved from 60% in 2000 to 40% prevalence in 2014, and was addressed by significant investment in agriculture and policies to increase resilience (an important initiative given the major droughts which impacted Ethiopia during the study period). This led to increased production of consumable, nutritious crops, which in turn contributed to improved household food security and nutritional status.

Ethiopia also invested in WASH policies and programs and community-level behavior change campaigns which dramatically reduced the rate of open defecation nationwide (from 82% in 2000 to 27% in 2015), likely contributing to a decline in infections. Diarrhea incidence dropped dramatically for all regions, especially in high population areas such as Southern Nations, Nationalities, and Peoples' Region (SNNPR) (the 3rd most populated area) where diarrhea incidence halved from 29% (the highest in the country in 2000) to 14% in 2016. This was likely not due to RTV given its late roll-out mentioned above. Though care-seeking behavior across the board remained low e.g. for ORS and zinc coverage, this drop in incidence impacted U5M attributable to diarrhea.

Ethiopia's health systems strengthening work during the study period was also a key facilitator of U5M progress and provided the platform for many of the implementation strategies for EBIs. The government prioritized expanding access to primary health care (PHC), particularly in rural areas. This was reflected in the country's activities, which included construction of new facilities (primarily health posts and health centers), some strengthening of hospital management, and HR for health improvement through expanded training and creation of new cadres of providers such as HEWs and integrated emergency surgical officers (IESOs). In particular, establishment of the HEP in 2003 to improve geographic access in

rural areas was key to delivering maternal and childcare. The HEP included trained and supervised HEWs originally in the rural areas and more recently expanded into urban areas as well as expansion of their scope.

Establishment of this program created health posts in rural areas manned by HEWs, who provided selected health services and community education and engagement both at health posts and homes in their communities. Though the program was originally created to provide education and preventative services, its scope expanded widely during the study period to provide a platform for the delivery of key EBIs such as iCCM, vaccines, ANC, and management of neonatal sepsis. HEWs are responsible for 16 primary health care packages of services, including family health, communicable disease prevention and management, hygiene and environmental health, and educational outreach. While HSS efforts and establishment and leveraging of the HEP improved access to health services (though not as successfully in the pastoralist regions as in the agrarian ones) and aided implementation of EBIs, care-seeking remained a notable challenge to achieving high coverage of many EBIs in Ethiopia as described below.

There were a number of other contextual factors which facilitated the decline in U5M at the global and national/Ministry of Health (MOH) levels as well as at the community and individual levels, even in the face of persistent gaps in coverage of a number of important EBIs and geographic inequity in mortality, morbidity, and coverage. At the global level, these factors included the setting goals and prioritization of U5M by the Millennium Development Goals and organizations such as World Health Organization (WHO) and others and expanding availability of donor resources. At the national/MOH level, strong national leadership, the strengthening of the health systems including a commitment to PHC facilitated progress as noted above. Finally, the national culture of data use to identify and prioritize gaps, and investment in health, which was used as a strategy, were facilitators.

A significant national effort which was critical to the reduction of the U5M was the implementation of major poverty reduction policies and social safety net programs that helped boost household income and food security by extension, in turn improving U5 child health and reducing incidence of diseases and improving access and resilience. Pro-poor policies such as the Sustainable Development and Reduction Program (rolled out in 2000), and the Plan for Accelerated and Sustained Development to End Poverty and the Growth and Transformation Plans (rolled out in 2010-15) were introduced to reduce poverty. In addition, Ethiopia established the Pharmaceuticals Fund and Supply Chain Agency in 2006 (which aimed to increase affordability and accessibility of pharmaceutical products) and a health development army (HDA), which aimed to increase uptake in health care services) with community solidarity funding in 2012. The government also funded projects that addressed priority health problems (e.g. construction of maternity waiting homes at health center level) as identified by community, promoted community health education, and developed a community health insurance scheme of 2015 to reduce financial barriers in accessing quality health care services for the poor.

The government also implemented a social protection program called the Productive Safety Net Programme beginning in 2005, which targeted chronically food-insecure woredas (districts) in six regions of the country (Afar, Amhara, Oromia, Southern Nations, Nationalities, and Peoples (SNNP), Somali, and

Tigray). Participating households receive cash or food payments in exchange for work building infrastructure or protecting the environment. However, poor households with limited labor capacity receive payments without requirements for labor. Program assessments have shown that the program's benefits include improved food security, likely contributing to improved nutritional status of children under 5 and subsequently reduced vulnerability to major CODs.

Similar to other Exemplar countries analyzed in prior case studies, at the community and individual levels, women's empowerment improved and there was increased uptake of reproductive health services. Unmet need for contraception dropped from 37% in 2000 to 23% in 2017, and satisfied demand for family planning increased a large amount from 19% in 2000 to 63% in 2014 (although demand was very low in some regions such as Afar). Adult female literacy improved from 19% in 2000 to 42% in 2016 nationwide, even in the setting of stagnant rates of completion of primary school.[1,2] These improvements were seen across all regions in Ethiopia except in pastoralist regions such as Somali where women literacy rate improved only slightly from 9% in 2000 to 12% in 2016 compared to Amhara where rates improved from 16% in 2000 to 45% in 2016.

Nonetheless, the work of Ethiopia from 2000-2015 has been challenged by a number of contextual factors which have been barriers in U5M reduction efforts. These have occurred at the global, national, and local/community levels. Like many countries, climate change presented a challenge, including major droughts in regions including Oromia. and were associated with periods of stark food insecurity. Ethiopia also had areas of conflict particularly along the Eritrean border affecting the regions of Tigray and Afar.

Other factors were present preventing the country from achieving equity in coverage, and posing as potential threats to sustaining and continuing progress. While the Federal Ministry of Health (FMOH) focused on increasing access to low coverage areas, especially through the HEP program, there remained large inequity of coverage in many EBIs and higher NMR and U5M across regions and populations including rural and most poor, and in areas with a high proportion of pastoralist populations.

One challenge has been how to ensure equity among the pastoralist community, facing geographic and cultural barriers. Access to health care in these regions with large pastoralist populations was also limited in part by the largely nomadic pastoralist lifestyle. The pastoralists in Ethiopia have a highly male dominated culture and report low literacy rates and completion of primary education. For example, Afar reported a 6.1% primary school completion rate for girls in 2016 versus the national levels overall of 54%. In Somali and Afar regions, where the large majority of pastoralists live (53% and 29% of the pastoralist population respectively), the U5M dropped by over 100 deaths/1000 the U5M between 2000 and 2016. In 2016 U5M was 94 per 1,000 live births in Somali and 125 per 1,000 live births in Afar, compared to the U5M in Addis Ababa (the capital of Ethiopia), which had a U5M of 39 per 1,000 live births in 2016.

In comparison to regional and rural/urban differences, the wealth inequity gap was virtually eliminated for U5 mortality as shown below (Figure 1). This likely reflected a combination of improved EBIs accompanied by contextual factors which targeted the poorest. While it also decreased for NMR, some differences still remained (Figure 2).

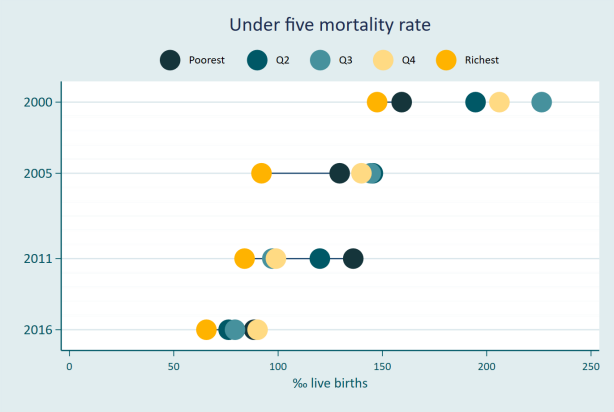


Figure 2: Equity Analysis of Under-5 Mortality Rate in Ethiopia (Source: Victora et al, 2018)

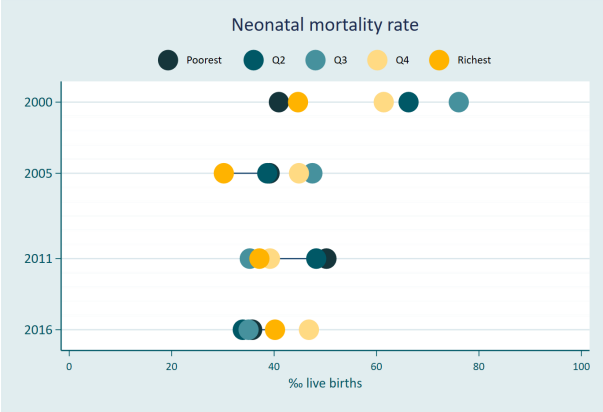


Figure 1: Equity Analysis of Neonatal Mortality Rate in Ethiopia (Source: Victora et al, 2018)

1.7 Transferrable Lessons

There are a number of transferable lessons which emerged from Ethiopia that would be relevant for other countries aiming to accelerate U5M reductions learning from Ethiopia's successes and challenges. These represent the success in dropping U5M and NMR, as well as the work that remains to ensure equity in coverage and reduction in morbidity and coverage. Ethiopia illustrates the importance of broad, intersectoral approaches to improving health outcomes, focusing within and beyond the health sector to address leading causes of mortality, reducing incidence, and improving resilience and access. This was done through pro-poor initiatives, public health initiatives, and addressing nutrition as a key risk for U5M and NMR. Actions included health systems strengthening targeting a strong PHC system which reflected the identified barriers including geographic access, HR, and facility coverage, and work to address cultural and regional-specific barriers by building on existing health system capacity rather than investing in vertical programs. Ethiopia also specifically shows the importance of building and leveraging a strong community health program and expanding to address emerging or persisting challenges from community engagement and education through service delivery (for example through neonatal sepsis interventions).

Additional effort is also needed to ensure quality and deeper engagement with communities to address the low uptake of HEW-delivered and some facility-delivered services. Other transferable lessons include engaging and leveraging the expertise of stakeholders and ensuring their alignment with national vision and goals as well as local priorities and barriers, using available evidence and data to identify need and work to improve data quality – a large ongoing initiative in Ethiopia – and building capacity to develop locally relevant evidence for decision-making and integration of new initiatives.

2 Introduction

2.1 Exemplars in Global Health

The Exemplars in Global Health project was started by Gates Ventures and cofounded by the Bill & Melinda Gates Foundation to inform high impact global health decisions by making it easier to replicate large-scale national and global health successes through evidence-based narratives. The core of the project is to identify the knowledge and evidence detailing the successes, as well as drivers of and barriers to those successes, among "exemplars" – positive outlier countries that have demonstrated outperformance relative to peers or beyond what might be expected given context and/or financing. The content goes beyond traditional research and peer-reviewed literature to better understand how these Exemplars were able to achieve success beyond their regional neighbors and other comparable countries. The analysis and conclusions are designed to be data-driven and rigorous, but also to create knowledge that is transferable and accessible and has the potential to be used across a range of key stakeholders. Therefore, the content developed by the Exemplars project is intended primarily for an audience of national policymakers, implementers, and funders – people with the potential to significantly impact global health policy and implementation at scale.

2.2 Exemplars in Under-5 Mortality

As a part of the broader Exemplars project, the University of Global Health Equity (UGHE) is working with teams at Gate Ventures and the Bill & Melinda Gates Foundation to better understand countries' successes in reducing U5M between 2000 and 2015/16. This work was designed with two aims: 1) developing and testing an implementation research framework and mixed methods approach to understand the successes of these countries, and 2) extracting actionable and transferable knowledge focused on implementation strategies and key contextual factors to inform other countries working towards the same goal. The scope of mortality was limited to amenable causes of death (COD) – those which are potentially preventable with a stronger and higher quality health care system. The work was divided into a number of activities. These included: 1) identifying evidence-based interventions (EBIs) in use in low- and middle-income countries (LMICs); 2) developing and applying an implementation science-based approach to understanding how the EBIs put into place by these Exemplar countries were prioritized, adapted, implemented, and sustained; 3) understanding how the evidence-based interventions implemented by a country were prioritized, adapted, implemented, and sustained through research into both existing publicly available sources and primary key informant interviews; and 4) identifying the key contextual factors and policy interventions critical to each country's success. The work was guided by the developed framework, which was informed by a number of frameworks in use for U5M (e.g. Countdown 2015, WHO) and implementation science. The framework and identified EBIs can be found in Appendix A.

With input from a technical advisory panel, seven countries meeting "exemplar" criteria for U5M were chosen based on the rates of decline in U5M compared with countries in their region or with similar economic resources. These countries were also chosen from a larger list of Exemplar countries to

represent a range of locations and sizes, with the goal of identifying varied implementation success factors common to countries that have over-performed in U5M.

2.3 Ethiopia

Background

Ethiopia is a large (426,400 mi²), landlocked country located in the Horn of Africa (Figure 3). It shares borders with Eritrea to the north, Djibouti and Somalia to the east, Sudan and South Sudan to the west, and Kenya to the south. The country features great geographical diversity. A large part of the country is comprised of mountain ranges and high plateaus, which are divided by the Great Rift Valley. More than half of the country lies above 1,500 meters above sea level. Ethiopia's climate is predominantly tropical monsoon, with three main topographic-induced variations in climate – Dega (cool) in the highlands over 2,500 meters above sea level, Weina Dega (warm to cool) in highlands between 1,500 and 2,500 meters above sea level, and Kolla (warm to hot) in lowlands. Ethiopia has three main seasons. The first, known as Belg, is a short rainy period from February to May. Kiremt is the longer rainy season for most of the country, lasting from June to September. The third season, Bega, brings dry and cool weather for most of the country between October and January. Ethiopia's unique topography and climates can affect child health, particularly due to the effect on malaria transmission. Highland areas above altitudes of 2,500 meters do not experience any malaria transmission. However, highland fringe areas between altitudes of 1,500 and 2,500 meters experience frequent malaria epidemics. Lowland areas below 1,500 meters have seasonal patterns of transmission, while stable malaria areas of the country experience transmission throughout the year.[3] Transmission often has an "unstable" epidemic-prone pattern with large variation in caseload from year to year.[4] Ethiopia has also experienced several severe droughts in recent history, which have contributed to significant food insecurity, migration, and political instability, all important factors impacting work to reduce U5M. During the study period, significant droughts in 2002-03 and 2011 led to food shortages and economic insecurity in the country.[5]

Ethiopia is composed of nine regional states and two city administrations (Figure 3):

Regional States

- Afar
- Amhara
- Benishangul-Gumuz
- Gambella
- Harari
- Oromia
- Somali
- Southern Nations, Nationalities, and Peoples' Region (SNNPR)
- Tigray

City Administrations

- Addis Ababa
- Dire Dawa

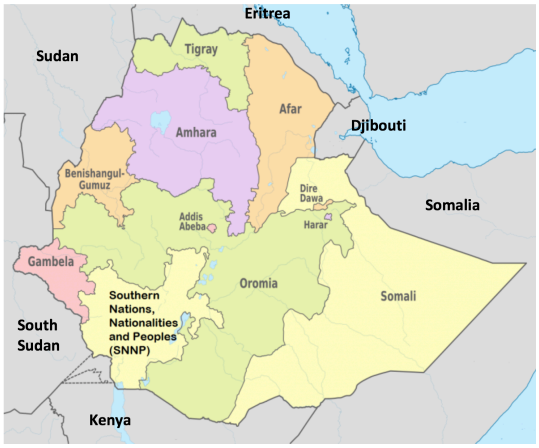


Figure 3: Map of Ethiopia (Source: ReliefWeb)

Regional states and city administrations are divided into 800 woredas (districts), which are further divided into over 30,000 kebeles (sub-districts).[6]

With a population of just over 100 million, Ethiopia is the second most populous country in Africa. While urbanization is increasing, 81% of the population lives in rural areas, which have substantially lower standards of living than urban areas. The majority of the population lives in the Amhara, Oromia, and Southern Nations, Nationalities, and Peoples (SNNP) regions, which together comprised an estimated 81% of the country's total population in 2012. The country's population has expanded steadily over time, growing from 66.5 million in 2000 to 99.9 million in 2015. In 2015, 42% of the country's population was under the age of 14.[7]

It is also an extremely ethnically diverse country consisting of more than 90 distinct ethnic groups who speak over 80 languages. Per the most recent (2007) national census, the largest ethnic groups in Ethiopia were the Oromo and Amhara, who made up 34% and 27% of the country's population, respectively. The most common religions in Ethiopia were Ethiopian Orthodox Christianity (44%) and Islam (35%).[8]

Pastoral areas made up two-thirds of all land in Ethiopia (see Figure 4). The pastoralist population of an estimated 10-12 million people live in several regions of the country. The large majority of pastoralists live in the Somali (53%) and Afar (29%) regions, though pastoralism also exists in Tigray, Benishangul-Gumuz, and Gambella.[9] These differences in population characteristics are important contextual factors in Ethiopia's work to expands EBIs and reduce U5M.

Figure 4: Pastoralist Areas of Ethiopia (Source: OpenLearn Create)

Economic Status and Development

Ethiopia had the fastest growing economy in Africa, growing by an average of 10.3% per year from 2006/07 to 2016/17, compared to a regional average of 5.4%. Its gross domestic product (GDP) grew from $8.24 billion in 2000 to $64.47 billion in 2015.[10] Ethiopia's economic growth is predominately attributable to agriculture, construction, and services. Its top exports in 2015 included coffee ($900M), refined petroleum ($693M), cut flowers ($606M), and gold ($577M).[11]

This economic growth has led to a reduction of poverty (measured by the proportion of the population living below $1.90 a day) in the country, from 38.7% in 2004 to 23.5% in 2015.[12] However, regional differences in poverty persist. In 2011, the poverty headcount ratio based on the national poverty line

ranged from 11.1% in Harari to 36.1% in Afar.[13] Ethiopia's human development index (HDI) also improved over the study period, increasing from 0.283 in 2000 to 0.451 in 2015.[14] Despite this improvement, Ethiopia remained one of the poorest countries in the world with a GDP per capita of $645.47 in 2015. However, Ethiopia has one of the lowest levels of income inequality in Africa, with a Gini index of 39.1 in 2015.[15]

The Ethiopian government has utilized five-year Growth and Transformation Plans since 2010 to guide economic improvement in the country. It is heavily engaged in the economy, owning key sectors such as telecommunications, banking and insurance, and power distribution. The government has also retained ownership of all land since 1991, a policy confirmed by the country's new constitution of 1995. However, it provides long-term land leases to tenants.[15]

Political Landscape and Context

Ethiopia is the oldest independent country in Africa and the only country on the continent to never be colonized. The Ethiopian Empire was established in about 1270 and was overthrown by the Derg, a military junta, in a 1974 coup d'état that deposed Emperor Haile Selassie. The Derg established a Marxist-Leninist state in Ethiopia led by Mengistu Haile Mariam that lasted until 1991 and was marked by political repression and resulting deaths from a violent political repression campaign (Qey Shibir) from 1976-78.[16]

Ethiopia's fourth and current constitution was adopted in 1994, establishing the Federal Democratic Republic of Ethiopia, with "nine regional states and two city administration councils under a constitutional federal system." Ethiopia's government is a federal parliamentary republic consisting of three branches. The executive branch includes the Prime Minister, Council of Ministers (including the Minister of Health), and Council of State. The legislative branch includes the House of Federation and the House of People's Representatives. The Judicial branch includes federal and regional courts.

In 1998, conflict over disputed land on the Ethiopian-Eritrean border of the Tigray and Afar regions led to a state of war between the two countries. In addition to an estimated 70,000 total casualties on both sides, Ethiopia faced a number of challenges as a result of the conflict. Both countries experienced massive displacement of civilians and exacerbated economic problems, leading to food shortages. Ethiopia additionally stopped using Eritrean ports for foreign trade in 1998. As the country is landlocked and reliant on foreign ports, its maritime traffic was handled by the Port of Djibouti. Though a peace agreement was signed by both governments in December 2000, tensions continued until leaders of both countries signed a joint declaration formally ending the state of war in July 2018.[16] Ethiopia's prime minister, Abiy Ahmed, subsequently received the Nobel Peace Prize in 2019 for his peacemaking efforts.[17]

Education

Overall, the educational status of Ethiopia's population has improved in recent years, but gaps remain. The overall adult literacy rate in the country grew from 27% in 1994 to 49% in 2015. In 2015, Ethiopia's primary school entrance increased remarkably from 40% in 2000 to close 85% in 2015 (76% for girls);

however, primary education completion (of the total population) was lower at 54%, although still an improvement from the 22% in 2000.[18,19]

Gender Equity

Gender equity has improved in some areas but remains a challenge in Ethiopia. Entrance into primary school increased, but remained lower for girls[20] and in 2016, the literacy rate of adult women was only 42%, compared to 67% in adult men.[2] In contrast, completion rates of secondary education in 2014 were comparable between men and women (92% and 91% respectively).[21]

Progress was seen over the study period in other areas of women's empowerment. For example, the percentage of married women currently employed increased from 32% in 2005 to 48% in 2016 (though still less than half of the rate of 88% of men employed).[22] The World Economic Forum's 2018 Global Gender Gap Report ranked Ethiopia 117th in gender equity of 149 total countries (compared to 100th of 115 countries in 2006), reflecting further progress required.[23]

Under-5 Mortality in Ethiopia

Following consistent but fairly slow progress in reducing U5M in Ethiopia leading up to the study period, U5M dropped from 166 deaths per 1,000 live births in 2000 (the country's first DHS, or Demographic and Health Survey) to 67 per 1,000 live births in 2016 (Figure 5). Decreases in U5M have occurred in all wealth quintiles (Figure 6), with the large gap between the wealthiest and other wealth quintiles nearly eliminated during this time period, although the patterns showed that, during the first part of the study period, the poorest quintile was not always the group with the highest U5M. U5M has decreased across all regions of the country (Figure 7). However, regional differences in U5M remain, ranging from 39 deaths per 1,000 live births in Addis Ababa to 125 deaths per 1,000 live births in Afar in 2016.[2,24]

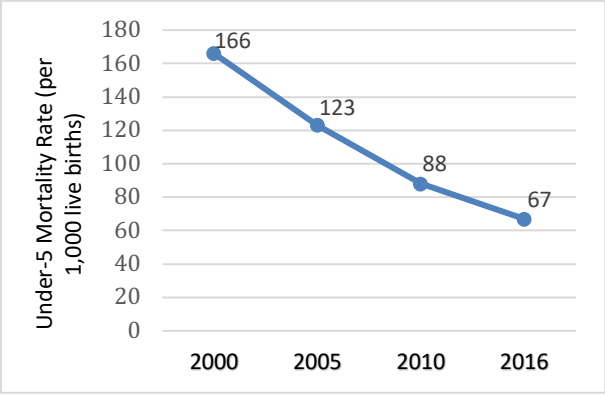


Figure 5: Under-5 Mortality Rate (per 1,000 live births) in Ethiopia (Source: DHS 2000, 2005, 2010, 2016)

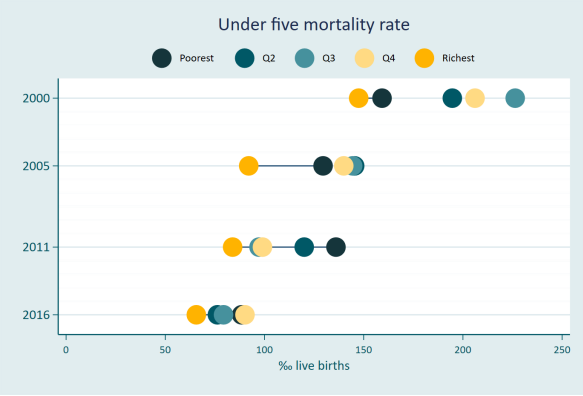


Figure 6: Equity Analysis of Under-5 Mortality Rate in Ethiopia (Source: Victora et al, 2018)

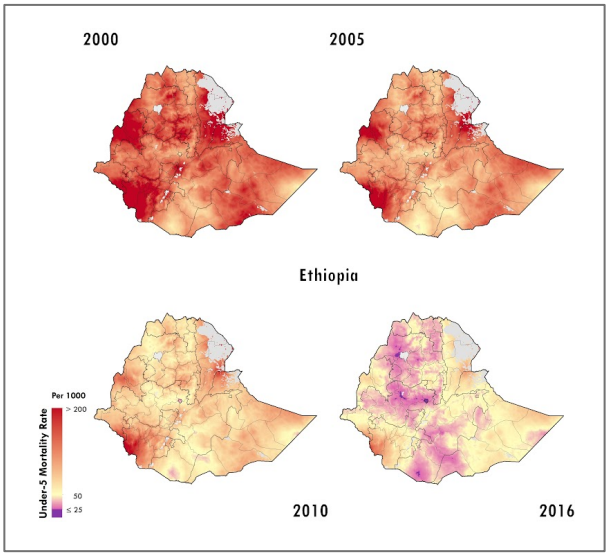


Figure 5: Map of Ethiopia Showing Trend of Under-5 Mortality, 2000-2016 (Source: IHME 2018)

Table 2: Under-5 and Neonatal Mortality Rates (Per 1,000 Live Births) by Region (Source: DHS)

Region	Under-5 mortality		Neonatal mortality	
	2000	2016	2000	2016
Addis Ababa	114	39	43	18
Afar	229	125	46	38
Amhara	183	85	60	47
Benishangul-Gumuz	198	98	65	35
Dire Dawa	176	93	42	36
Gambella	233	88	57	36
Harari	191	72	54	34
Oromia	194	79	61	37
SNNPR	192	88	49	35
Somali	184	94	60	41
Tigray	169	59	68	34

Neonatal Mortality in Ethiopia

Ethiopia has also shown impressive declines in its NMR. Per the DHS, NMR in Ethiopia dropped from 97 deaths per 1,000 live births in 2000 to 48 per 1,000 live births in 2016 (Figure 9). Similar to U5M, NMRs have decreased across regions and wealth quintiles. Notably, equity plots (Figure 10) show that NMR was actually highest in the 4th and wealthiest quintiles in 2016. However, a key informant expressed that this may actually be due to under-reporting of mortality in the lower wealth quintiles, particularly due to high levels of home delivery. Geographic differences also remain (Table 2 and Figure 8); in 2016, Addis Ababa had the lowest NMR (18 per 1,000 live births), while Amhara had the highest (47 per 1,000 live births).[2,1]

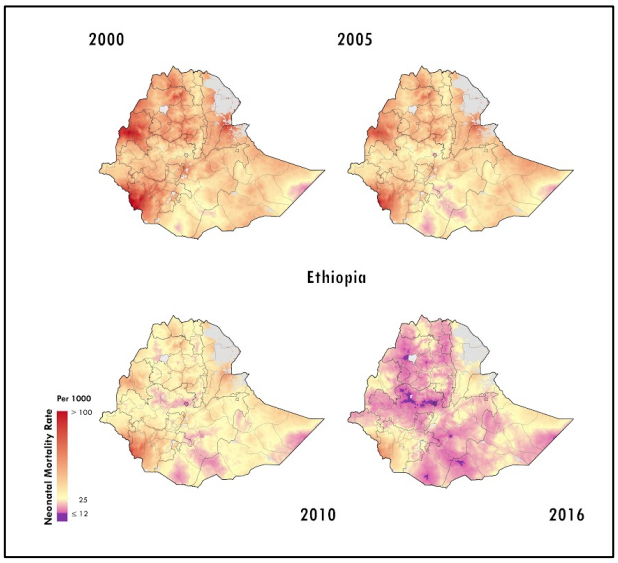


Figure 9: Map of Ethiopia Showing Trend of Neonatal Mortality, 2000-2016 (Source: IHME 2018)

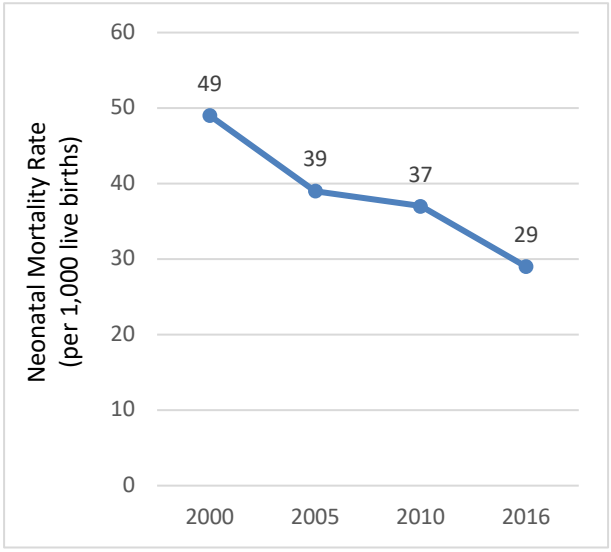


Figure 8: Neonatal Mortality Rate in Ethiopia (Source: DHS 2000, 2005, 2010, 2016)

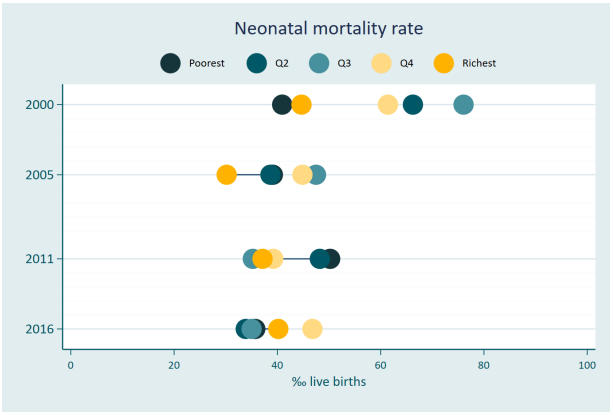


Figure 7: Equity Analysis of Neonatal Mortality Rate in Ethiopia (Source: Victoria, et al 2018)

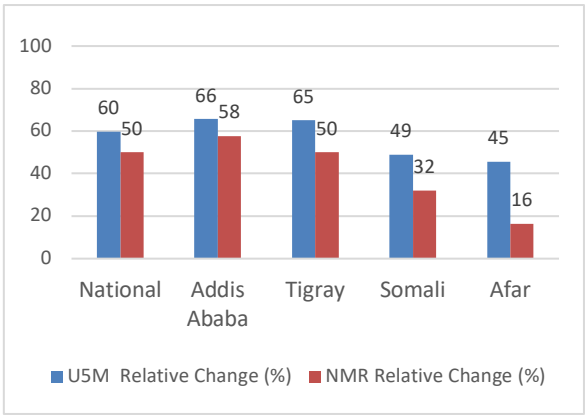


Figure 6: Relative reduction in U5M and NMR in the best and least performing regions in reducing U5M, Ethiopia (Source: DHS 2000 and 2016)

Regional variability U5M and NMR

While Ethiopia saw a relative reduction of U5M and NMR by 60% and 50%, respectively, there was subnational variability with decreases in rates from 46% (Afar) to 67% (Addis Ababa) (Figure 11) for U5M and from 58% to 14% for NMR.[1,2] However, while Ethiopia did have some success in reducing the geographic equity gap in U5M rates from 119 to 86 it remained relatively unchanged in NMR (26.3 to29 absolute difference in rates, +2.7 gap).[1,2] Potential contextual factors which were identified as more common in the lowest coverage areas included lower female literacy,[1,2] higher proportion of pastoralist communities,9 border conflict and higher residual rates of stunting.[1,2]

Health System Organization and Governance

Health System Structure

Ethiopia's health system has three tiers (Figure 12):[25]

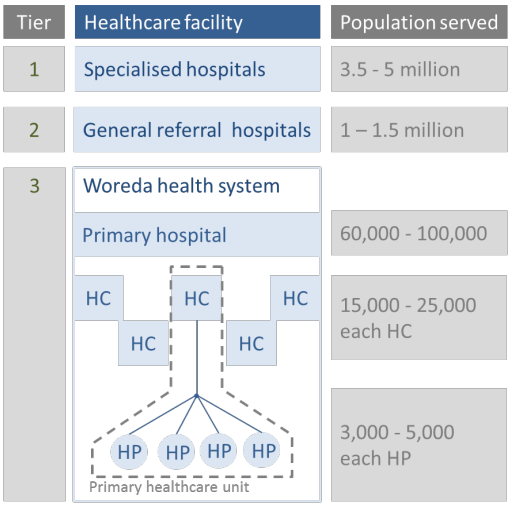


Figure 10: Ethiopia's Three-Tier Health System (Source: Teklu, 2019)

1. Primary

The primary level includes the Primary Health Care (PHC) Unit, which consists of five health posts, one health center, and one primary hospital in rural areas. Health posts are staffed by two health extension workers (HEW) (see below) who provide preventive, promotive, and basic curative services in addition to community-based activities for populations of 3,000 to 5,000 people.

Health centers, which serve a catchment of 15,000-25,000, are staffed by around 20 health care workers (HCWs) including health officers, nurses, midwives, and sometimes general practitioners.[26] These facilities also provide preventive and curative care, inpatient and ambulatory services, treatment of common psychiatric disorders, and dental services. Delivery services and basic emergency obstetric and newborn care (BEmONC) are provided at health centers.

Primary hospitals, which are staffed by about 53 HCWs including physicians, health officers, nurses, midwives, anesthetists, and integrated emergency surgical officers (IESO), provide comprehensive emergency obstetric and newborn care (CEmONC) services and emergency surgical services including Caesarean sections (C-section) in addition to services provided by health centers. These facilities cover a catchment of 60,000-100,000 people.[26]

The primary level differs in urban areas, where it consists of one health center serving 35,000 people.

2. Secondary

The secondary level consists of general, district level hospitals serving 1 million to 1.5 million people. These hospitals are staffed by approximately 234 staff, including specialist physicians and nurses, and provide both inpatient and ambulatory services.

3. *Tertiary*

The tertiary level, which is the highest level of the health care system, includes six specialized hospitals.[27] Specialized hospitals have a staff of around 440 (including physicians and nurses). These hospitals serve as referral centers for general hospitals for catchment areas of 3.5 million to 5 million people.[24]

Beginning in 1998, the Federal Ministry of Health (FMOH) has invested in expansion of public health facilities under the Health Sector Development Programs through funds from both the central treasury and the national Millennium Development Goal (MDG) Pool Fund, particularly in order to improve access to PHC. The FMOH entered agreements with regional governments to share costs of construction of new health facilities, particularly health centers and primary hospitals, to expand access to health services. Though the financing of construction was split evenly by the FMOH and regional governments, the FMOH committed to equipping all new facilities built under these agreements. By 2014, Ethiopia's public health system grew to 14,416 health posts, 2,689 health centers, and 111 public hospitals.

Similar to the public health sector, the private health sector in Ethiopia has experienced substantial growth. In 2007-8, Addis Ababa alone had 25 private hospitals.[28] Utilization of care at private facilities also increased during the study period. The 2016 DHS reported that 1.1% of women nationally, but 22.2% of women in Addis Ababa, delivered at a private facility, compared to 0.5% and 11% respectively in 2005.[29] Private facilities are also increasingly utilized in care-seeking for childhood illness. In 2016, 16% of children with symptoms of ARI and 20% with diarrhea for whom advice or treatment was sought visited a private sector facility.[2] However, a 2011 study revealed that the private health sector in Addis Ababa experienced similar challenges as faced by the public sector, such lack of trained specialists, health worker turnover and availability, and quality of drugs and services.[28]

Despite the work to strengthen the health care delivery, health systems remain weaker in pastoralist areas of the country, which are affected by issues in infrastructure and access. As explained by a key informant:

> *"Most policies and guidelines that are developed federally focus on reaching the huge population and settled communities which are easy to reach…we invest a lot and we see a lot of change. If you go to the pastoralist communities the infrastructure… health can't really work alone, there are other infrastructures needed and development is generally weak around there. That's why those geographic areas have health system problems and…the health outcome will be very poor. In addition to that, most of the guides, principles, and successes are usually in the settled communities. The ways they do business are structured and routine."*

Service Provision Assessment Plus (SPA+) data from 2014 found variable availability of basic services, including child vaccination, curative care for children under 5, family planning, antenatal care (ANC), and normal delivery, in facilities across Ethiopia. While availability of services for curative care for children under 5, family planning, and ANC were provided at most health posts and higher level facilities, availability of normal delivery services was not universal (65% of non-health post facilities and 45% of health posts). Most health posts (82%) provided child vaccination services, though less than half (49%) of higher level facilities did (Figure 13).[30]

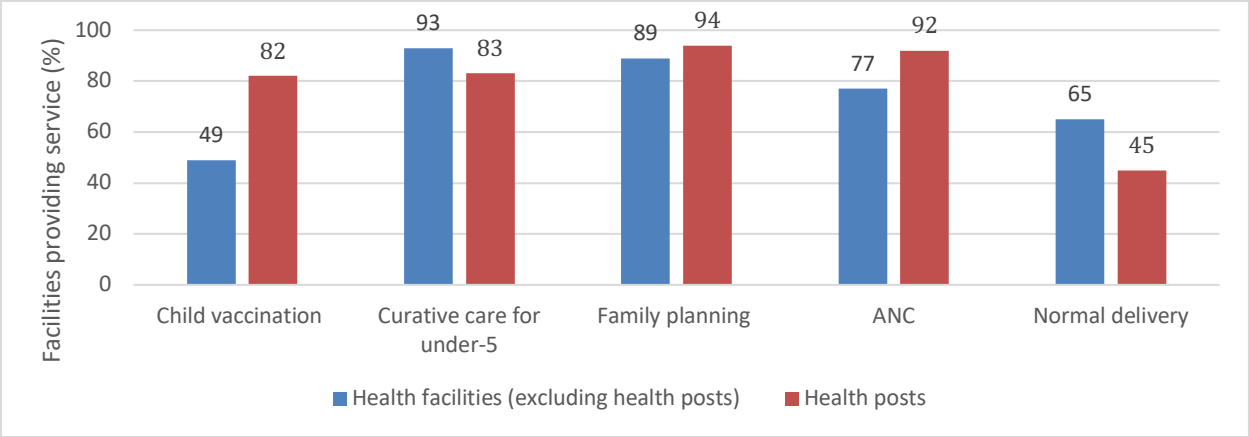


Figure 11: Facilities Providing Selected Basic Health Services in Ethiopia in 2014 (Source: ESPA+ 2014)

Human Resources for Health

Like many countries in the region, Ethiopia has faced challenges with both number and distribution of health care human resources (HR) in the country (Table 2).[31] In 2010, the country had low national health workforce density of 0.7 per 1,000 population, far lower than the minimum 2.3 per 1,000 population recommended by the WHO.[32] The Government of Ethiopia uses a "lottery mechanism" to deploy higher-level cadres of health workers to rural areas. However, distribution of these providers is uneven across regions of the country, with more providers per population in Addis Ababa, Dire Dawa, and Harari but fewer per population in pastoralist regions (Table 3).[27] Gaps in other trained HCWs including nurses and, critically, midwives were also documented. A key informant explained Ethiopia's ongoing challenges in HRs for health:

> *"Currently [in] the public sector, most of the health professionals are not happy with the salary they are getting, with the due payment they are getting, with the allowance, and so on. Even if you have very good infrastructure, very good software system, very good equipment, if you do not have the skillful, competent, and motivated human resources, you could not achieve anything and these are the challenges we have."*

National Health Sector Development Plans focused on HR development to alleviate shortages. The government continued to emphasize expansion of health service training institutions throughout the country in order to increase the number of graduates entering the health system as providers. As a result of these efforts, the number of universities and health service colleges has increased from five in 2003 to 22 in 2009.[33]

In 2009, the majority of health workers overall in Ethiopia worked in the public sector; only 5.8% of all health workers formally worked in the private sector. However, this was quite different for physicians, with 15% of general practitioners and 40% of physician specialists reported working full time in the private sector. Dual practice in both public and private sectors is also common in Ethiopia, with many workers in the public sector seeking additional work in the private sector to supplement low public sector incomes.[31]

Table 3: Total Numbers and Density of Key Health Worker Categories in Ethiopia, 2009

Category	Number	Ratio per 1,000 population
Physicians	2,152	0.03
Nurses	20,109	0.36
Midwives	1,379	0.02
HEWs	34,382	0.43
Health officers	1,606	0.02

Table 4: Distribution of Physicians, Nurses, Midwives, and HEWs Across Regions and City Administrations of Ethiopia, 2009

Region	Physicians		Nurses		Midwives		HEW	
	Physicians	Physician: Population Ratio	Nurses	Nurse: Population Ratio	Midwives	Midwife: Population Ratio	HEWs	HEW: Population Ratio
Addis Ababa	934	1:3,056	3,377	1:845	244	1:11,699	N/A	N/A
Afar	15	***1:98,258***	185	1:7,967	-	-	572	1:2,577
Amhara	304	1:58,567	3,790	1:4,698	212	1:83,983	7,471	1:2,383
Benishangul-Gumuz	12	1:59,309	452	1:1,575	37	1:19,235	499	1:1,426
Dire Dawa	53	1:6,796	272	1:1,324	20	1:18,009	142	1:2,537
Gambella	13	1:25,585	91	1,3,655	4	1:83,150	457	1:728
Harari	29	1:6,655	276	1:699	29	1:6,655	47	1:4,106
Oromia	378	***1:76,075***	5,040	1:5,706	287	***1:100,197***	13,856	1:2,075
SNNPR	242	1:65,817	3,980	1:4,002	316	1:50,404	7,915	1:2,012
Somali	71	1:65,817	314	1:14,882	45	***1:103,844***	1,427	1:3,275
Tigray	101	1:44,880	2,332	1:1,944	185	1:24,502	1,433	1:3,163

In response to the gap, the FMOH worked towards meeting the country's need for additional providers through innovative programs such as the Health Extension Program (HEP) in 2002 and the IESO initiative in 2009, which created new cadres of providers to support task sharing discussed below.

Health Extension Program (see also Contextual Factors)

The Government of Ethiopia introduced the HEP, the first national community health program in the country, in 2002 to provide expanded community-based care, working towards universal PHC coverage. The HEP introduced a cadre of full-time, salaried, supervised, female (with few exceptions in certain regions) HEWs in 2003. HEWs had to be at least 18 years old, completed at least a 10th grade education (except in some pastoralist areas), and speak the local language. They were selected from the communities they served by committees nominated by the community and representatives from woreda offices. HEWs complete a one-year pre-service training utilizing a curriculum which prepared them to offer a service package of 16 services (see Table 3) at the community level. This package was broad, expanding beyond that of community health workers (CHWs) in many countries to include provision of services such as childbirth delivery and administration of vaccinations.

Table 5: Health Extension Program Services Package (2014)[34]

Service package	Key elements
1. Collect, maintain, and utilize community health data	• Plan and prepare necessary materials for data collection • Collect data to be entered into health database • Collect vital events and surveillance data • Prepare and submit reports • Contribute to working with community to identify health needs
2. Perform community mobilization and provide health education	• Participate in determination of community health education needs • Participate in preparation of health information • Provide health promotion and education services • Train model families • Perform advocacy of identified health issues • Promote community health mobilization on identified health issues
3. Promote and implement hygiene and environmental health	• Promote and provide environmental and personal hygiene education • Establish and demonstrate community-appropriate sanitation technologies • Provide environmental health service
4. Prevent and control common communicable diseases	• Educate the community on early detection and prevention of communicable diseases • Perform disease surveillance • Follow up cases
5. Prevent and control common noncommunicable diseases	• Educate the community on healthy lifestyle and early detection of disease • Screen and refer clients requiring further investigation and management • Follow up cases and promote community-based rehabilitation
6. Promote community nutrition	• Collect appropriate information for preparing nutrition education • Provide basic nutrition information/education to clients • Monitor client response to the information/education
7. Promote and provide ANC	• Provide antenatal examination and information for pregnant women • Conduct home visit and refer pregnant women with health problems
8. Promote institutional delivery and provide delivery service	• Support women during childbirth • Provide normal delivery • Provide immediate neonatal care
9. Promote and provide postnatal care (PNC)	• Provide services for lactating mothers on infant care, nutrition, and exclusive breastfeeding • Organize and follow up maternal health programs
10. Promote child survival, growth and development, and apply Integrated Community Case Management (iCCM)	• Promote child survival and growth and development activities • Assess and manage common childhood illness • Refer children requiring further care

Service package	Key elements
11. Promote and implement immunization	• Plan immunization programs • Conduct immunization programs and administering vaccines
12. Promote and provide family planning services	• Educate the community on family planning options • Educate adolescents on family planning and STIs
13. Promote and provide adolescent and youth reproductive health	• Plan and promote adolescent and youth reproductive health services • Provide family planning • Provide reproductive health service package • Register and document reproductive health registers
14. Provide first aid	• Assess and identify client's condition • Provide first aid • Refer clients providing further care
15. Manage community health services	• Follow organizational guidelines, understand health policy and service delivery system • Work ethically • Provide team leadership and assign responsibilities • Establish quality standards, assess and record quality of service delivery • Manage work and resources at a health post • Lead workplace communication
16. Respond to emergencies	• Prepare for and evaluate emergency situations • Act in an emergency • Apply essential first aid techniques

Two HEWs are assigned to one health post, which covers a catchment area of 3,000 to 5,000 people. HEWs spend time working both in the community and at the health post. Although health posts are run by HEWs, HEWs are supervised by personnel at health centers corresponding to their health post's catchment area.

The HEP initially focused on health promotion and prevention activities at the time of its launch in 2003 (Table 3). As shown in Figure 14, the program's service packaged underwent several changes over the study period that expanded its scope. The government broadened the scope of the program's service package from 2005 to 2007. These changes allowed HEWs to treat malaria, diarrhea, and severe acute malnutrition in addition to providing other services such as childbirth delivery at health posts. The program's service package continued to expand, with case follow-up for HIV and TB included in 2008. In 2010, pneumonia treatment and iCCM were formally integrated into the program's services (see EBI section on ICCM). With the intention of improving the quality of care provided at the health post, to upgrade the HEW, and to respond to gaps identified in the HEW level three curriculum, a new level of HEW called L4HEW was initiated. Between 2010 and 2013, over 4,700 HEWs from across the country enrolled in the upgrading program.[34,35] Community-based newborn care (CBNC) was also added in 2014.

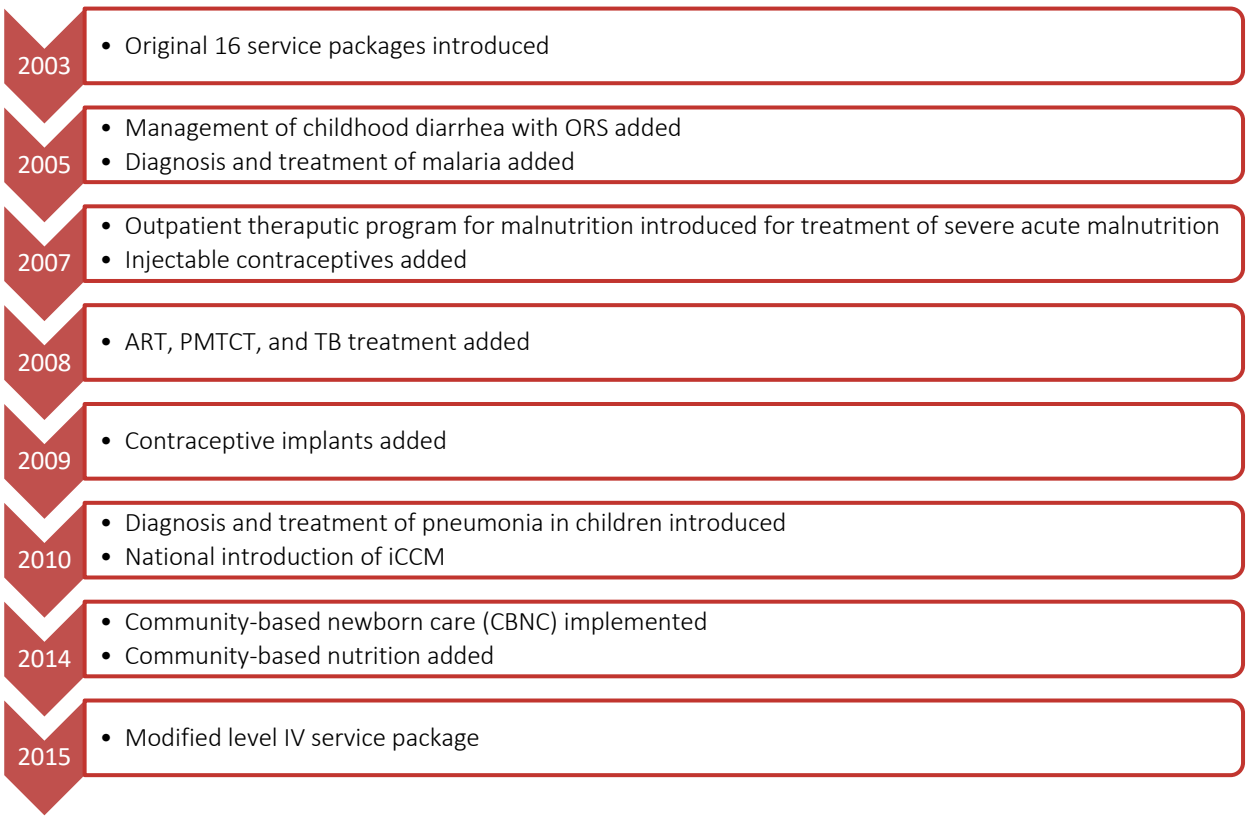


Figure 12: Evolution of the Health Extension Service Package[36]

The Model Family concept was added to the HEP in 2006. HEWs train model families to adopt healthy practices to serve as role models for their peers in the community. These families receive 96 hours of training by HEWs as part of a course covering the 16 to 18 health packages. Following completion of this training, model families promote healthy behaviors such as use of insecticide-treated nets (ITN) and breastfeeding in their communities under supervision of HEWs.

In 2012, further expanding community-based resources, the FMOH introduced part-time, unpaid Health Development Army (HAD) volunteers to strengthen the HEP. This cadre of community health volunteers who were members of model families, consisted of Women Development Groups (WDG) comprised of 30 households or about 150 people, divided into five "one-to-five networks" so that a single volunteer would work with five households or about 30 people. WDG Leaders supervised leaders of "one-to-five networks" and were directly supervised by HEWs. Women's Development Army volunteers supported HEWs by reducing the HEW outreach burden and promoting service utilization. Their activities included assisting with promotion of immunization campaigns, monitoring pregnancies and illnesses, and aiding with communications between HEWs and the households they served. HDA volunteer also met weekly with community members to discuss topics related to child health, maternal health, ANC, nutrition, and hygiene.[35,36,24]

By 2009/10, the government had trained and deployed 34,482 HEWs across all regions of the country excluding Addis Ababa[34] because the focus was in rural areas.[37] In 2009/10, regional availability of HEWs

varied widely – from 1:728 population in Gambella (pastoralist) to 1:6,031 in the urban area of Harari (Table 4). These HEWs trained and graduated over 12 million model families and mobilized almost 443,000 HDAs.[34] In 2017, after the study period was ended, there were more than 42,000 HEWs across the country.[38]

Key informants emphasized the important role of the HEP in reducing under-5 mortality (U5M) in Ethiopia. As one key informant explained:

> *"So much of the achievements or efforts [bore] fruits after the introduction of [the] Health Extension Programs, particularly for the under-5 child mortality reduction…There is not one single bullet but there [was] multifaceted effort and bear fruits to what we are today. It is difficult to say there is one and only one initiative but the major umbrella I would say could be the health extension program into which [was] imbedded management of childhood illness, and the newborn community-based initiatives along with integration of child immunization program into the Health Extension Program and this Health Extension Program encompasses both rural and urban communities. That is one area that has contributed much of the reduction to under-5 mortality."*

However, the large scope of the HEP and increasing burden of work placed on HEWs remains a challenge despite the creation of model families and the HDA to focus on community education, activation, and follow-up. According to a key informant, HEWs are becoming overburdened due to their growing scope of work, contributing to burnout and turnover.

Table 6: Population to HEW Ratio by Region, 2009/10[34]

Region	Population per 1 HEW
Urban	
Addis Ababa	Not available
Dire Dawa	4,867
Harari	6,031
Rural	
Amhara	2,775
Oromia	2,234
SNNP	2,126
Tigray	3,600
Pastoral	
Afar	3,930
Benishangul-Gumuz	1,426
Gambella	728
Somali	4,248
National	**2,545**

Decentralization

The country's second phase of decentralization, following initial decentralization with adoption of the 1994 constitution, occurred with the 2002 District-level Decentralization Program. This pushed administrative and management (including financial and HR) functions from the regional to the district/woreda level. Under these changes, woredas received block grants from regions and managed the allocation of funds to public governmental health offices. They became responsible for recruitment of all government staff working at the woreda, including at health facilities, and assumed responsibility for planning, construction, and management of these facilities. Woredas also developed their own health strategies, implementation plans, and monitoring and evaluation frameworks in alignment with national policies. Though decentralization provided regions and the administrative levels below them with more independence and agency, one key informant noted that subnational activities still had to align with federal priorities in order to receive federal funding. However, a key informant noted that regions are often still able to focus on their own specific priority areas based on regional needs. For example, while a new Health Sector Transformation Plan (HSTP) may focus on improving quality of care, a region may still receive FMOH support to focus on improving access if this area of focus of the previous national health plan still needed improvement.

Health Sector Planning and Coordination

Health sector activities in Ethiopia are guided by five-year strategic plans. These plans are developed based on national health policy launched in 1993. The FMOH develops the strategic plans in collaboration with stakeholders, civil societies, professional societies, and regional health bureaus (RHB) through a series of consultative meetings and workshops. It sets priorities using both local data, such as Health Management Information System (HMIS) and national surveys, and international evidence. Explaining the importance of data-based planning and decision-making in Ethiopia, one key informant noted *"when you develop evidence-based policy formulation process, you have to have clear data. Even if you engage stakeholders, the stakeholders should be supported by local and international data and I think this data led us to prioritize the important initiatives in drafting strategic objectives."*

These plans contain strategic objectives. Each year, the FMOH drafts a core action plan guided by these objectives. Reflecting the decentralization of authority, RHBs, which fall under autonomous regional governments, develop their own plans and budgets, but as noted above, are still expected to align with the FMOH strategic plan priorities in order to receive federal funding. Every two months, heads and planners of all RHBs attend joint streaming committee meetings chaired by the Minister of Health in order to coordinate activities. Planning also occurs at the woreda level supported by the RHB and the FMOH, which allocate money to support planned activities.

Health sector planning also includes involvement and coordination of implementing partners and donors. Ethiopia uses a "one plan, one budget, and one report" concept, in which all implementing partners and donors in the country must align their activities with the FMOH's priorities and plans. Resource mapping is used to coordinate implementing partner plans and allocate resources towards government priorities.

Health Financing

Between 2000 and 2015, Ethiopia's total health expenditure (from government and external sources) increased from $700.4 million United States Dollars (USD) to around $2.9 billion USD. Its health expenditure per capita also increased from $11 USD to $29 USD (Figure 15). However, even in the face of economic growth, the percent of GDP spent on health has remained fairly unchanged since 2000 (5.2% to 5.4% in 2015). In 2015, the percent of GDP spent on health in Ethiopia (5.4%) was similar than its neighbor Sudan (5.2%), lower than Kenya (6.4%) and Somalia (13.1%), and higher than Eritrea (3.9%) and South Sudan (3.1%).

Ethiopia's national health expenditure is largely financed by external sources, including grants from external organizations and governments. The proportion of funding from external sources rose over the study period. In 2000, external funding made up only 15% of total health spending, though this proportion grew to 28% in 2015. Government spending as a proportion of this total declined from 41% in 2000 to only 21% in 2015 (Figure 16).[39] The country's out-of-pocket (OOP) expenditure per capita remained steady from 2000 to 2005 and then steadily increased from $2.08 USD in 2005 to $9.18 USD in 2015.[40] OOP expenditure as a percentage of health expenditure in Ethiopia also remained high during the study period, reaching a high of 46% in 2011, though a decrease was observed over the next four years to 38% in 2015.

In 2015, the FMOH established the MDG Performance Fund to finance the health sector.[41] The country's various partners and donors contributed to this pooled fund. The FMOH then allocated this money, which was not earmarked for specific programs or disease areas, into its own priority areas such as infrastructure improvement. This fund was replaced by the Sustainable Development Goal (SDG) Performance Fund in 2015, which uses the same strategy to support the HSTP.

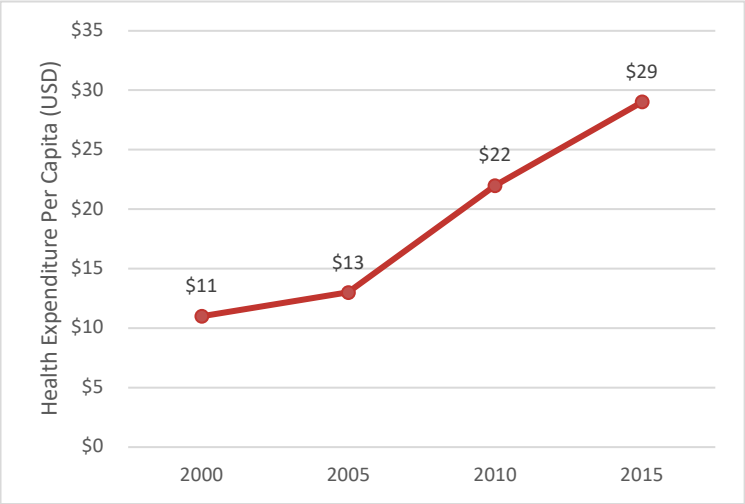


Figure 13: Health Expenditure Per Capita in Ethiopia (2000-2015)

Health Insurance

During most of the study period, there was no national level health insurance. In 2012, community-based health insurance (CBHI) was piloted in 13 woredas in Amhara, Oromia, SNNPR, and Tigray, which possess the largest share of the country's population, to improve access and reduce financial hardship related to seeking health services in the poorest populations. This insurance is primarily intended to cover essential health service packages at the health center level and include both inpatient and outpatient care for those covered under the scheme.

Under Ethiopia's CBHI program, kebele (the smallest administrative unit in Ethiopia) offices screen poor households for CBHI eligibility and woreda-level managers determine eligibility based on income. If eligible, enrollment to the scheme is done on a household, rather than individual, basis. Households contribute amounts ranging from $0.56 to $0.80, depending on the region, each month. These premiums are pooled into a collective fund managed by members, which is used to cover health care costs.[42] The federal government provides a 25% subsidy for all members, while woredas and regions finance a solidarity fund for the poorest households.[43]

The program's coverage rose steadily from about 144,000 households (about 660,000 beneficiaries) in 2012/2013 to over 3.9 million households (nearly 18 million beneficiaries) in 2017/2018. By 2017/18, CBHI schemes covered about 18% of Ethiopia's total population. The HSTP established a target of reaching 80% of woredas and 80% of the population by 2020, requiring further progress.[44]

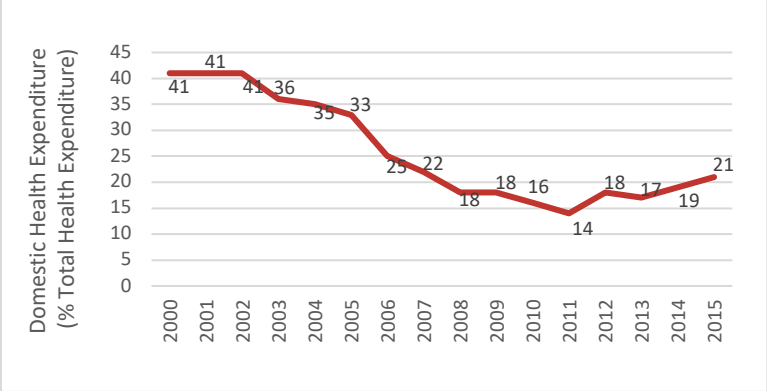


Figure 14: Domestic Expenditure as % of Total Health Expenditure in Ethiopia (2000-2015)

Health Equity in Health Care

The Composite Coverage Index used by the Countdown to 2030 initiative to track progress in coverage for reproductive, maternal, newborn, and child health shows improvement across all wealth quintiles. There are the greatest disparities between the poorest and wealthiest quintiles in ANC (75% in Q5 vs. 17% in Q1) and in skilled birth services utilization (45.6% in Q5 vs. 1.7% in Q1). However, it does not show any major narrowing of the equity gap in composite coverage between 2000 and 2016 (Figure 17).

Between urban and rural areas, the Countdown to 2030 initiative reported a decrease in disparity of rural vs. urban disparity U5M between 2000 and 2011. Due to initial large differential, there was a greater rate of decrease in U5M in rural areas, and geographic disparity still remains.[45]

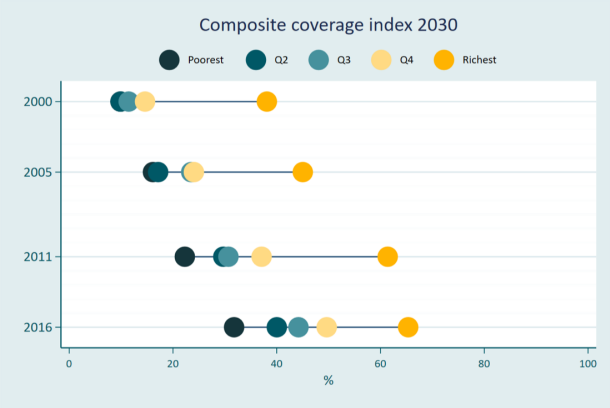


Figure 15: Composite Coverage Index in Ethiopia by Wealth and Year (Source: Victora et al, Countdown 2030 Equity Profile)

3 Methods for Case Study

The methodology was designed to achieve the following goals of generating new and actionable insights through applying implementation science methods to selected Exemplar countries to:

- Identify and evaluate the methods of deciding on the policies and EBIs to reduce U5M and their implementation strategies and execution
- Understand supporting and obstructing contextual factors from these countries

3.1 Project Framework

Both the desk review and the primary research are informed by an implementation science framework designed specifically for this project (see Appendix A). While we are often able to identify policies and EBIs chosen by a country to reduce U5M, the key lessons in how these were chosen, adapted, implemented, and sustained are often missing from available published or gray literature. Because the same policies and interventions brought different results in different countries, implementation science offers important tools for how to think more holistically about how and why countries were able to reduce U5M, and from where lessons in replication can be drawn. To guide the overall work, we developed a framework to understand the contribution of contextual factors and the different levels of actors involved: global, national, ministry, subnational, facility, and community. Details and the framework can be found in the appendix.

3.2 Desk Review

The Gates Ventures and UGHE teams undertook an extensive review of available information and published data on the rates and progress of U5M, including policies, strategies, EBIs available to potential Exemplar countries, and the uptake and implementation of these EBIs in Ethiopia. Initial secondary research was performed through MEDLINE (PubMed) and Google Scholar using the search terms “child mortality” or “under-5 mortality” and Ethiopia. Further searches included specific EBIs, causes of death, or contextual factors as search terms (e.g. “insecticide-treated nets,” “malaria,” or “community health workers”). Initial desk research by the Strategic Analysis, Research, & Training (START) Center at the University of Washington was synthesized and then reviewed by the UGHE team for accuracy and completeness. Following this, additional support was provided by the UGHE team to increase the capture of published literature relevant to the work.

The desk review was an iterative process, with ongoing additions occurring throughout the primary research process as additional sources (published articles, reports, case studies) were identified. Reflecting the scope on U5M-specific interventions (EBIs), we did not include in-depth reviews of important contextual factors including interventions that contributed to U5M reduction, such as education, poverty reduction, water and sanitation, and programs designed to improve nutritional status

beyond sever acute malnutrition and breastfeeding, but included evidence of increased coverage of EBIs where available and relevant and from existing reviews of those factors in Ethiopia.

3.3 Primary Research

In collaboration with our in-country partners in Ethiopia, Monitoring, Evaluation, Research, Training and Quality Improvement (MERQ) Consultancy, we identified key informants reflecting a broad range of experience and viewpoints. Key informants were chosen based on the topics identified in the desk review and through other analyses in the close collaboration with in-country partners, prioritizing those key informants (KIs) able to provide information on the EPIAS (Exploration, Preparation, Implementation, Adaptation, and Sustainment) stages during the period of study. Key informants included current and former MOH employees responsible for high-level strategic direction of the ministry or specific disease or intervention areas; implementing partners; and other multilateral organizations or donor organizations who had managed partner- supported or partner-led activities. Some informants represented more than one area or role based on their experience over the 16 years and were interviewed for each of their multiple viewpoints. While we prioritized individuals active in the study period but were able to also capture some experiences from 1995-2000 and after 2016.

Informed by the framework and review of relevant literature on contextual factors and implementation outcomes, we developed core interview guides for four main routes of inquiry.

1. Global and national level actors;
2. Ministry of Health (MOH) actors;
3. Project managers and implementers for specific CODs or EBIs; and
4. Other partners

The interviews were designed to address the EBI implementation process, from exploration to preparation, implementation, adaptation, and sustainment. This included critical contextual factors at the relevant global, national, ministry, and local levels. The interviews also identified additional sources of data and information which could be added to the knowledge base and understanding already developed from the desk review.

All interviews were led by the project research associates or the in-country principal investigator, with support from in-country researchers taking notes and operating recorders. Following the close of the interviews, tape recordings were transcribed.

All interviews were conducted in English.

3.4 Analysis and Synthesis

The UGHE team used a mixed methods explanatory approach, applying the framework to understand the progress (or lack thereof) for each COD and coverage of chosen EBIs, as well as facilitators and barriers at the local, national, and global levels. This approach aimed to create a better understanding of what, how, and why the Government of Ethiopia was able to achieve success in decreasing U5M and what the challenges were. The analyses were also informed by the extensive work completed by other initiatives, including Countdown 2015, WHO maternal and child health initiatives, the International Center for Equity in Health, and others.

KI interviews were coded by the researchers using a codebook developed from the framework and expanded based on findings from previous and this framework was used to extract the EPIS (Exploration, Preparation, Implementation, and Sustainment) steps and contextual factors. A priori codes for contextual factors were adapted and expanded as emerging themes were identified. Due to resource constraints and the range and diversity of interviewees, qualitative analysis using software was not planned.

3.5 Human Subjects Review

The study was reviewed by the relevant Institutional Review Boards (IRB) in Rwanda and Ethiopia. All key informant interviewees provided verbal informed consent before interviews were conducted.

4 Specific Causes of Death and Evidence-Based Interventions

We prioritized EBIs based on the specific CODs for children under 5 in Ethiopia based on modeling from the Institute for Health Metrics and Evaluation (IHME) of relative rates of different CODs in U5 and neonatal populations (Tables 3 and 4). RIs and diarrheal diseases were the leading CODs throughout the study period. Measles, which was the 3rd leading COD in 2000, showed the most dramatic drop, followed by malaria, tetanus, and HIV/AIDS.

Table 7: Causes of Death in Ethiopia Per 100,000 of Population Under 5 (Source: IHME)

Cause of Death	Rate of deaths per 100,000 of U5 population (% of deaths)		
	2000	2005	2016
Respiratory infections (RI)	571.5 (17.1%)	444.3 (17.7%)	178.8 (14.1%)
Diarrheal diseases	423.8 (12.7%)	304.2 (12.2%)	191.4 (15.1%)
Measles	384.1 (11.5%)	197.5 (7.9%)	69.9 (5.5%)
Malnutrition	211.6 (6.3%)	140.7 (5.6%)	56.5 (4.5%)
Malaria	78.6 (2.4%)	78.6 (3.1%)	6.2 (0.5%)
Meningitis	112.8 (3.4%)	90.5 (3.6%)	38.3 (3.0%)
HIV/AIDS	171.3 (5.1%)	106.5 (4.3%)	17.6 (1.4%)
Tetanus	46.8 (1.4%)	23.9 (1.0%)	6.3 (0.5%)
Diphtheria	13.1 (0.4%)	4.4 (0.2%)	0.9 (0.1%)

Table 8: Causes of Death in Ethiopia Per 100,000 of Neonatal Population (Source: IHME)

Cause of Death	Rate of deaths per 100,000 of neonatal population (% of deaths)					
	2000		2005		2016	
	Early Neonatal	Late Neonatal	Early Neonatal	Late Neonatal	Early Neonatal	Late Neonatal
Preterm birth	40,629 (23.7%)	1,839 (8%)	32,793 (21.3%)	1,421 (7.7%)	20,601 (19.6%)	711 (7.1%)
Birth asphyxia and birth trauma	57,878 (33.7%)	2,043 (8.9%)	57,085 (37.1%)	1,792 (9.7%)	38,562 (36.7%)	935 (9.4%)
Sepsis and other neonatal infections	11,138 (6.5%)	3,637 (15.8%)	10,970 (7.1%)	3,450 (18.7%)	8,981 (8.5%)	2,352 (23.6%)
Congenital birth defects	3,970 (2.3%)	673 (2.9%)	4,524 (2.9%)	677 (3.7%)	5,547 (5.3%)	594 (6%)
Respiratory infections	13,024 (7.6%)	2,340 (18.8%)	11,021 (7.2%)	3,240 (17.5%)	6,178 (5.9%)	1,308 (13.2%)
Diarrheal diseases	2,139 (1.3%)	2,038 (8.8%)	1,661 (1.1%)	1,452 (7.2%)	1,356 (1.3%)	1,005 (10.1%)
Tetanus	3,538 (2.1%)	1,621 (7%)	1,920 (1.3%)	853 (4.6%)	552 (0.5%)	218 (2.2%)

Among neonates, birth asphyxia remained the cause for one-third of early neonatal deaths, followed by preterm complications in one-fourth of deaths. For later neonatal deaths (defined as death between 7 and 28 days of birth), infections were leading cause of mortality. See Appendix A for a complete listing of U5M CODs and EBIs considered in this case study.

4.1 Pneumonia, Diarrhea, and Malaria

4.1.1 Facility-Based Integrated Management of Childhood Illness

Table 9: Facility-Based IMCI Key Implementation Strategies

Implementation Strategies
• Adaptation from global recommendations • Pilot testing • Rapid expansion after pilot • Data use for planning, prioritization, and action • Use of country experts and professional organizations • Donor support and partner support in implementing • Donor and implementing partner coordination • Rapid decentralization of scale capacity • Supportive supervision and algorithms to improve quality • Decision aids

EXPLORATION

Integrated Management of Childhood Illness (IMCI) was developed by WHO and the United Nations Children's Fund (UNICEF) in 1996.[46] The strategy focuses on improving health providers' ability to diagnose and treat common illnesses in countries with high child mortality, strengthening health systems and improving family and community health behaviors through integrating health education. The Government of Ethiopia was an early adopter of IMCI after playing a key role as a collaborator in the early development of the strategy.[47]

Ethiopia started with a small pilot as part of the development of WHO's IMCI materials, training six health workers in health centers in the Gondar District in IMCI in the first test of a draft version of the WHO/UNICEF IMCI course. However, a study conducted in 1997 found variable quality in these workers' ability to assess, classify, and treat sick children under the age of 5 after training. Assessment of commonly seen signs for IMCI illnesses had sensitivities (representing ability to diagnose) ranging from 67-91%, though assessment of less commonly seen or less easily quantifiable signs was fair or poor (20-45% sensitivity). IMCI case management charts were subsequently revised based on these findings.[48]

PREPARATION

Following the pilot, Ethiopia adopted IMCI in 1997 as the main strategy for improving child health. Going beyond the typical scope of IMCI prevention and control of diarrhea, acute respiratory infections (ARI), and malaria, the program sought to address major childhood illnesses in Ethiopia[47] to include malnutrition, measles, and eventually HIV/AIDS follow-up. The FMOH worked with partners such as the Ethiopian Pediatric Society to adapt WHO's generic IMCI materials to fit the local context. In addition to training modules, other materials for use in the facilities such as chart booklets and handbooks were adapted in preparation for introduction of IMCI.

After adaptation, IMCI was subsequently piloted in 27 facilities across Addis Ababa, SNNPR, and Tigray beginning in May 2000. Each of the three regions established regional IMCI task forces and conducted regional orientation workshops to ensure effective implementation.[47]

IMPLEMENTATION

Expansion of the IMCI program began in 2001 aiming for all regions in Ethiopia with support from a range of partners Including WHO, UNICEF, and additional partners varying by region. These partners aided in financial support and nationwide training at the zonal or facility levels. Expansion of the 11-day training to the entire country was conducted over a period of approximately one year. Regions were prioritized to receive training based on factors such as disease burden, while individual facilities were prioritized based on burden and patient flow by RHBs. As a key informant explained, *"the Ministry of Health gave us the contacts of regional health bureaus and the regional health bureaus told us their budget and sent us the number of people to be trained. We conduct accordingly and people were selected from different health facilities."* Facilities received additional support through post-training follow-up visits conducted within six weeks after the initial training. The FMOH also conducted quarterly supportive supervision visits to facilities, often in tandem with implementing partners that conducted supervision every three to six months.

To help ensure high quality of implementation at the facility level, IMCI chart booklets containing algorithms for case management were available and utilized at health centers and hospitals for classification and treatment. To further support scale and sustainability, IMCI was soon integrated into pre-service training for health workers. Despite this focus on ensuring quality, a key informant noted that the quality of IMCI implementation has still been challenged by high rates of health worker turnover at the facility level.

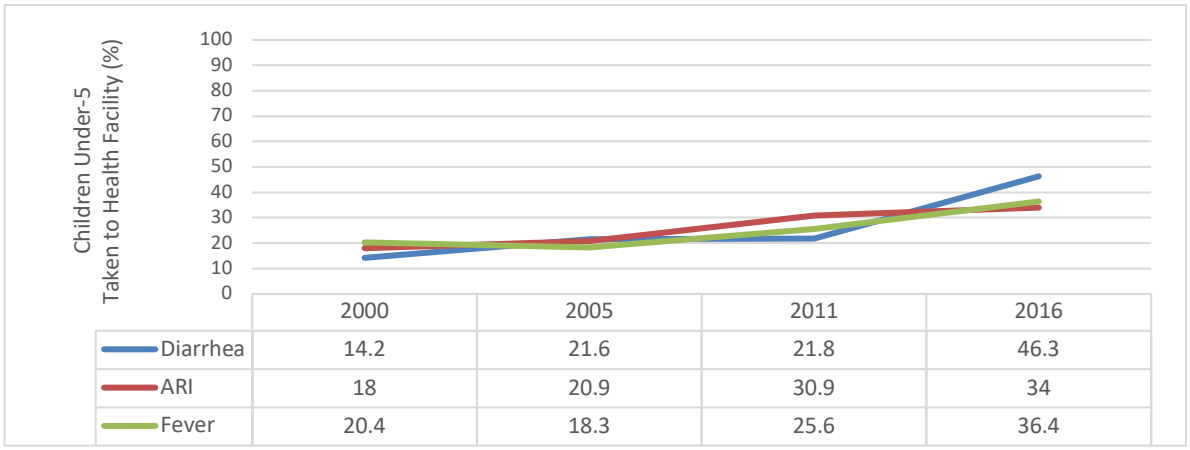
Although the Health Sector Development Programme (HSDP)-II set a target of 80% of facilities providing IMCI, in 2006, only 29% of districts had at least one health facility providing IMCI and 39% of hospitals and health centers evaluated had at least one health worker trained in IMCI.[49] An evaluation of the HSDP-II identified budget constraints and delays due to financial regulations and lack of trainers as barriers to full rapid program expansion. The next iteration of the national Health Sector Development Program, the HSDP-III, was released in 2005. In order to improve delivery of family health services, the strategy set a target of expanding implementation of IMCI from 36% to 90% of health facilities in the country by 2010.

In order to increase the number of health providers trained in IMCI, it also aimed to improve availability of pre-service IMCI training from 65% to 95% of health professional teaching institutions through training of additional instructors and provision of financial and material institutional support.[50]

Despite this work, the 2014 ESPA+ found ongoing gaps in the capacity and provision of IMCI services in facilities across Ethiopia, more than a decade after the program's introduction. Among 1,103 facilities surveyed offering outpatient curative care for sick children, 69% possessed IMCI guidelines. Only 28% of facilities had at least one staff member who had received in-service IMCI training, but this assessment did not account for incorporation of IMCI into pre-service training and likely underestimated the availability of trained providers. However, the quality of care as assessed by direct observations was also low. For example, in observed cases, providers only assessed 5% of children for all IMCI danger signs (inability to eat, drink, or breastfeed, vomiting everything, and convulsions). Treatment rates were somewhat better but varied with condition. A very high percentage (83%) of children diagnosed with pneumonia were given antibiotics, but fewer than half (40%) of children diagnosed with malaria received antimalarial drugs and 20% received artemisinin-based combination therapy (ACT). ORS was prescribed for 69% of children diagnosed with diarrhea without dehydration and 66% of those diagnosed with diarrhea with dehydration. Provision of zinc was much lower and was prescribed for only 16% and 8% of children in these groups, respectively.[30]

Despite these challenges, DHS reported that care-seeking at health facilities for children under 5 with diarrhea, ARI symptoms, or fever increased from 2000 to 2016 (Figure 18) but still remained low in all three conditions, with the greatest increase for diarrhea from 14% in 2000 to 46% in 2016.

Increased utilization of IMCI services at facilities likely reflected both higher availability of these services at primary health facilities, demand-side interventions such as community engagement plus provision through the HEP as part of iCCM (as described below). Though improvement in care-seeking was reported, regional differences still remained as shown in Table 9. For example, the 2016 DHS reported that regional care-seeking for fever ranged broadly from 59% of children in Harari to only 27% in Somali. Equity plots (Figures 19, 20, and 21) show that while care-seeking has improved nearly across wealth



	2000	2005	2011	2016
Diarrhea	14.2	21.6	21.8	46.3
ARI	18	20.9	30.9	34
Fever	20.4	18.3	25.6	36.4

Figure 16: Care-seeking at Facility for Children Under 5, 2000-2016 (Source: DHS 2000, 2005, 2011, 2016)

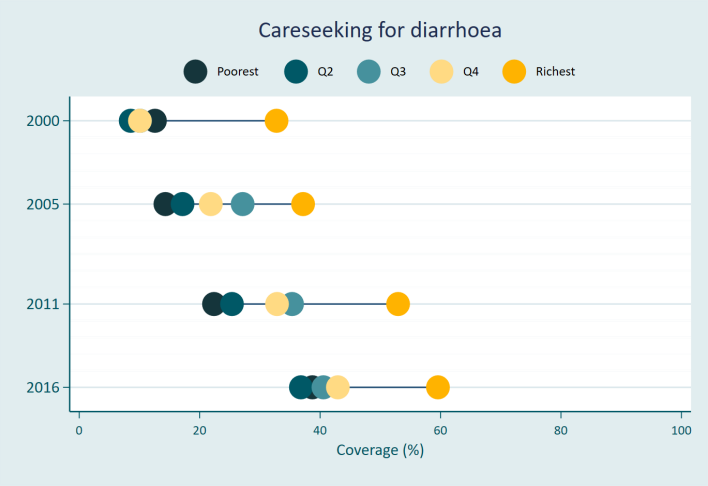


Figure 17: Equity of Care-Seeking for Fever 2000-2016 (Source: Victoria et al, 2018)

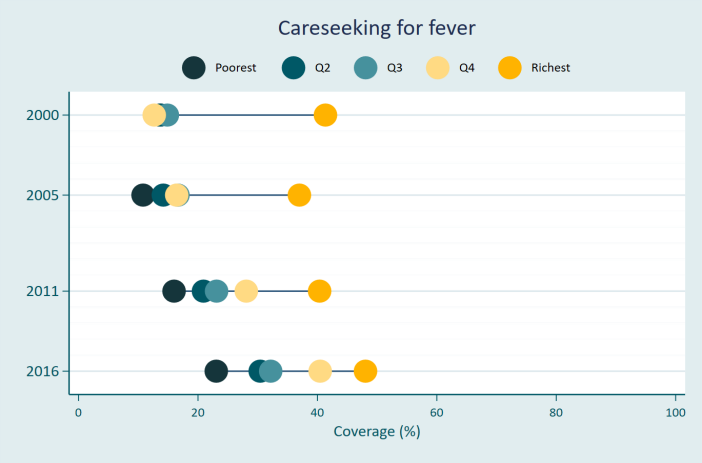


Figure 18: Equity of Care-Seeking for Diarrhea 2000-2016 (Source: Victoria et al, 2018)

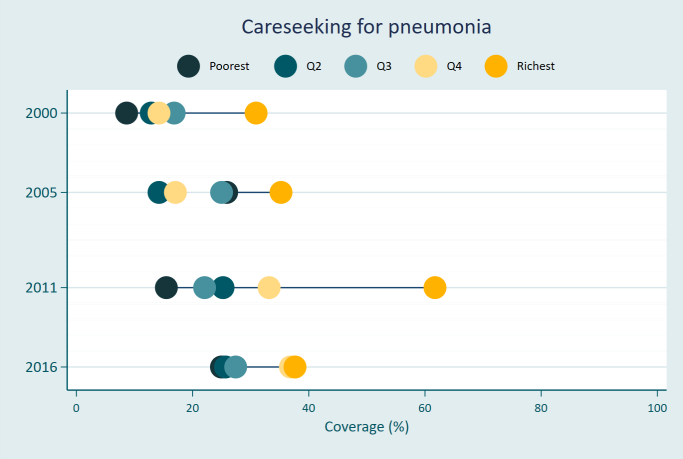


Figure 19: Equity of Care-Seeking for Pneumonia 2000-2016 (Source: Victoria et al, 2018)

quintiles, gaps in equity of care-seeking for diarrhea and fever have not improved. For care-seeking for diarrhea, the equity gap remained virtually unchanged, with very similar coverage in the first four wealth quintiles and much higher care-seeking in the wealthiest. For fever, improvement in coverage was limited and while the gap between the wealthiest and quintiles 2, 3, and 4 did lessen, it remained nearly unchanged between the poorest and wealthiest. The equity gap did narrow for care-seeking for pneumonia. While coverage for the first four quintiles was extremely similar, a gap persisted between the wealthiest and all others.[22]

Table 10: Care -seeking at Facility for Children Under 5 by Region, 2016 (Source: DHS 2016)

Region	Children taken to a health facility by illness (%)		
	Diarrhea	ARI	Fever
Addis Ababa	50	Not available*	57
Afar	59	53	45
Amhara	41	28	32
Ben-Gumuz	65	Not available*	44
Dire Dawa	66	Not available*	66
Gambella	61	Not available*	52
Harari	62	Not available*	59
Oromia	45	30	39
SNNP	50	45	35
Somali	46	Not available*	27
Tigray	52	39	39
*: regional data not available from DHS due to inadequate sample size			

ADAPTATION DURING IMPLEMENTATION

In response to growing resistance against sulfadoxine-pyrimethamine in Ethiopia, updated national malaria treatment guidelines released in July 2004 established artemether-lumefantrine, an ACT, as the new first-line drug and for rapid diagnostic testing- (RDT) confirmed *P. falciparum* malaria cases.[51] Introduction of ACT in the public sector began the following year, reaching all levels of health facilities. In the first year of ACT introduction, 10.2 million courses were distributed.[52] However, as discussed above, the 2014 ESPA+ found low provision of ACT (20%) in children diagnosed with malaria even a decade later.

In 2013, the original 11-day training in Ethiopia was shortened to six days, improving feasibility and reducing training costs in addition to the earlier change in inclusion in pre-service training.[53] Over the study period, national IMCI guidelines and training materials have been adapted several times in alignment with WHO's changes to treatment guidelines and nationally produced data.

SUSTAINMENT

Implementation of facility-based IMCI continued and was later accompanied by a community-based program in 2010. The HSTP for 2015/16 to 2019/20 called for further expansion of IMCI. The plan set a target of achieving coverage of 100% of health facilities providing Integrated Management of Neonatal and Childhood Illness (IMNCI) services in Ethiopia by 2020.[44] By 2016-2017, 3,778 health facilities across all regions of the country provided IMNCI services, though coverage within regions was incomplete. To ensure quality, the FMOH collaborated with its partners and relevant stakeholders to develop a three-year Quality Improvement and Transition Plan for the program.[54]

Table 11: Facility-Based IMCI Implementation Strategy and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness		
Acceptability		Care-seeking at facilities increased, but remained <50% or lower
Feasibility	Pilot testing and adaptation Adaptation to reflect updated national treatment guidelines Donor and implementing partner support and coordination Pre-service training and reduction in training duration Use of country experts and professional organizations	(+) Scale up to having some IMCI facilities in all regions by within one year (-) Full coverage was not achieved as planned
Effectiveness and Coverage (Reach)	Rapid scale after pilot Training and supportive supervision Change in malaria treatment due to resistance Rapid decentralization of scale capacity	(+/-) While improved, less than 50% of children under 5 with diarrhea, ARI, and fever received care at facilities (see Figure 18) (+/-) Decrease in deaths attributed to lower respiratory infections (14.6% to 13.1%) and malaria (2.4% to 0.4%) from 2000 to 2015, though no improvement in diarrhea-related mortality (12.7% to 15%)[55]
Fidelity	Use of supportive supervision Use of algorithms Data use for planning, prioritization, and action Decision aids	(-) Only 28% of facilities assessed in 2014 ESPA+ had at least one staff member who received in-service training (although may underestimate as preservice training had expanded) (-) <50% of children by 2016 seeking care for the 3 main areas (Fever, diarrhea, ARI) from facilities and varying rates of correct diagnosis and treatment
Cost	Shortening of training duration to improve costs beginning in 2013	
Sustainability	National HSTP (2015-2020) emphasizes continued expansion of the program	
Equity	Expansion in all regions Free services provided	

4.1.2 Integrated Community Case Management

Table 12: Integrated Community Case Management Key Implementation Strategies

Implementation Strategies
• Integration into existing HEP • Leveraging donor and partner support • Coordination of partner support • Monitoring and evaluation • Data use for decision-making • Adaptive management • Supportive supervision • Quality improvement activities • Decentralization and standardization of training

EXPLORATION

The first utilization of community management of childhood illness in Ethiopia began well before the official development of iCCM. In 1987, the Butajira Rural Health Program, a collaboration between Addis Ababa University and Umea University built health posts in the Butajira area and trained community health agents to administer cotrimoxazole for presumed RI, paracetamol for fever, and to refer to health centers for immunization and severe illness.[56]

Additional regional-level community health efforts were introduced in Ethiopia over time. During Ethiopia's civil war, the Tigray region established a CHW program of 3,000 volunteers, who diagnosed and treated malaria in Tigray People's Liberation Front soldiers and their families. In 1992, following conclusion of the war, the Tigray RHB developed a formal community-based malaria control program with a cadre of CHWs whose activities included diagnosis and treatment of malaria.[34,35]

PREPARATION

As described in the Introduction section, the FMOH's HEP was launched in 2003. The curative services included in iCCM were not originally intended to be provided by the program's HEWs and were not included in their initial scope of work, but this program would later provide a platform for iCCM.[57] Work to expand the scope of the HEWs started before the FMOH's adoption of iCCM. A series of partner-implemented studies demonstrated feasibility of iCCM provision by HEWs and led to policy changes gradually resulting in introduction of iCCM components. For malaria, a two-phase pilot project from May 2005 to April 2007 showed the feasibility of integrating the use of RDTs and ACT by HEWs. During the project's first phase, artemether-lumefantrine was distributed via 33 HEWs and at health facilities in the intervention district, but solely at health facilities in the control districts. In the second phase, half of the HEWs in the intervention district used RDTs to confirm *P. falciparum* infection and dispensed artemether-

lumefantrine to only RDT-positive patients. In the intervention district, HEWs provided rapid diagnosis and treatment to almost 60% of suspected malaria cases. Health facilities in this district had a nearly 46% lower case load of malaria. There was a significantly decreased risk of malaria-specific mortality in the intervention district compared to the control district.[58]

Large-scale of curative services at the community level began in 2007 after the FMOH permitted malaria and diarrhea treatment by HEWs. However, provision of antibiotics for treatment of pneumonia by HEWs began three years later. Growing global evidence that CHWs could effectively diagnose and treat pneumonia led the FMOH's partners to advocate for allowing HEWs to also provide this care in Ethiopia. UNICEF, the Ethiopian Pediatrics Society, the National Child Survival Strategy Working Group, and other partners strongly urged the FMOH to introduce pneumonia treatment by HEWs and therefore permit the full set of iCCM interventions. However, the Prime Minister and FMOH leadership were hesitant to allow this change despite the strong urging of RHB heads following a multi-stakeholder trip to India to observe administration of antibiotics by CHWs. Despite this advocacy and strong global evidence, the FMOH informed its partners that it required local evidence on feasibility of HEWs providing antibiotics prior to integrating this service into the HEP.[59]

In response to this request, John Snow Inc (JSI) implemented a pilot study to generate this evidence. From 2006 to 2008, JSI's Essential Services for Health in Ethiopia project piloted the full iCCM package provided by HEWs in the Boloso Sore Woreda of Ethiopia's SNNP region. During this pilot, HEWs received training and mentorship on the elements of iCCM (management of malaria, diarrhea, pneumonia) expanded to include essential newborn care. In addition, they were trained in classification and referral for newborn infection, severe malnutrition, and HIV. The project further strengthened other HEP packages such as provision of immunization and feeding promotion for infants and young children.[60]

Similarly, in 2007 Save the Children started implementing another child survival project that further informed development of iCCM in Ethiopia, entitled "Innovation for Scale: Enhancing Ethiopia's Health Extension Package" in the two woredas with some of the highest U5M rates (SNNPR's Shebedino and Lanfero woredas) from 2007-2013. This project expanded the work of HEWs already working within the HEP to include IMNCI. Activities of the project included conducting clinical IMNCI training for HEWs and advocating for policy change to enable community-level assessment and treatment of pneumonia with oral antibiotics by HEWs. HDA volunteers were utilized to promote behavior change and increased use of expanded services.[60]

In 2010, the FMOH released a policy change in pneumonia treatment guidelines that coincided with planning activities for implementation of the enhanced HEP and the iCCM program. As part of this change, treatment of pneumonia was introduced into the mandate of HEWs six years after the release of WHO/UNICEF recommendations that pneumonia be treated at the community level.[61] Since Ethiopia previously endorsed all global policy recommendations for iCCM, addition of the new pneumonia case management policy resulted in a full-scope iCCM program in place within the HEP.

Since the country already had a strong national community health platform and several components of iCCM had already been integrated, the FMOH planned to introduce a formal national iCCM program within the HEP, implemented by HEWs at households and health posts. As explained by a key informant,

> *"When IMNCI was introduced into the country it focused on health centers, higher level facilities whereby curative services are given, health workers are trained and deployed; but the access was not really as huge as it was expected. Then the government decided to have the Health Extension Program/Workers to provide some preventive and promotive services, so iCCM is a revolution of IMNCI at a community level. Ethiopia chose to implement iCCM with the Health Extension Program because it did have that platform already and it was then a very logical choice."*

The FMOH leveraged the support of many partners during this planning process as well later during the program's implementation. The program was designed by the FMOH in collaboration with UNICEF, WHO, and a range of other implementing partners (including Save the Children, JSI/Last Ten Kilometers [L10K] Project, and United States Agency for International Development [USAID]'s Integrated Family Health Program [IFHP]). The FMOH established Technical Working Groups (TWG) at national and regional levels. Members of the TWG included local universities, the Ethiopian Pediatric Society, and individual consultants. These groups' preparatory activities included developing the national implementation plan, standardized training materials, job aids, and monitoring and evaluation frameworks and tools.

Extensive involvement of TWG members in development of training materials helped ensure standardization of training despite multiple implementers that would later provide in-service training to HEWs. ICCM was covered in five of the 16 HEW training modules: 1) family health, 2) environmental sanitation and hygiene, 3) disease prevention and control, 4) health education and communication, and 5) maternal and child health.[59]

Additional preparatory activities by the TWG included establishment of a national database for iCCM managed by the FMOH and UNICEF. This database consisted of data collected from training, supervision visits, and performance review clinical mentoring meetings (see Implementation), which was entered by implementing partners. These data were intended to be used for both monitoring and quality improvement of the program.[56]

IMPLEMENTATION

Ethiopia's national iCCM program was officially launched in February 2010 within the HEP. Implementation was supported by different funding sources, including the Canadian international Development Agency, the MDG pool fund, and other funding commitments from the FMOH and its development partners. The program was launched in a phased manner, which improved feasibility of expansion in the large country. It was first introduced at a small scale in seven zones in two regions, which were selected based on the strength of the HEP in those zones. Operational challenges were identified in implementation and used to inform further scale-up. ICCM was then scaled to 14 zones and eventually to the entire country. The country's four agrarian regions (Amhara, Oromia, SNNP, and Tigray) were first targeted for implementation due to their greater population density and strength of implementation of

the HEP. In 2013, iCCM was expanded to three additional regions (Benishangul-Gumuz, Gambella, and Afar) and later, it finally reached the remaining two regions of Harari and Somali. The number of health posts providing iCCM increased rapidly from 4,510 in 2011 to 13,500 in 2013. Over this three-year period, HEWs treated a total of 290,950 cases of malaria, 323,839 cases of suspected pneumonia, and 562,044 cases of diarrhea.[56] By 2014, nearly 30,000 HEWs working in 14,500 health posts across eight regions were participating in iCCM. At that time, 86% of districts in Ethiopia were covered by iCCM services. However, gaps in implementation coverage remained in areas such as the Somali region.[62]

Training of HEWs used a cascaded, train-the-trainer approach often utilized in introduction of new programs and interventions in the country. It began with a seven-day national training of a group of master trainers from the FMOH, implementing partners (typically international organizations), and local universities. These master trainers then cascaded training to regions and woredas. For increased efficiency, district-level trainings were organized by various implementing partners depending on where the partners already worked.[6] HEWs received a six-day training on management of pneumonia, diarrhea, malaria, and malnutrition among children under 5 in addition to the standard 12-month training for HEWs. Use of standard training guidelines helped achieve consistency throughout the country regardless of the implementing partner conducting the training. ICCM was also integrated into standard pre-service training for HEWs, ensuring new HEWs trained after introduction would also be educated in this area.

The program also utilized clinical mentorship and supportive supervision to ensure full, high-quality implementation of iCCM at health posts. Trainers visited each health posts four to six weeks after the initial training to monitor performance. In some areas, HEWs did not receive certification until after this follow-up visit occurred. Yearly performance review clinical mentoring meetings also began six months after the training. These two-day meetings were facilitated by health workers trained as trainers for 20-40 HEWs. Day one of the meetings consisted of registry review by supervisors and peer-HEWs to assess consistency, completeness, and caseloads (in comparison to expected caseloads). Day two of the meetings was dedicated to mentoring of HEWs by peer HEWs. In addition to these meetings, HEWs received supportive supervision visits on a quarterly basis, with iCCM integrated into routine HEP supervision. Though ensuring continued supportive supervision occurred through integration into the routine supervision was identified as a challenge by key informants, advocacy by TWGs and inclusion of iCCM indicators in the HMIS facilitated integration of these visits.

A 2012 study assessed strength of iCCM implementation and quality of care provided by HEWs in the Jimma and West Hararghe zones of Oromia, about one year following beginning of iCCM implementation in the areas where iCCM had been introduced. It found that 98% of HEWs working in areas in which iCCM had been already implemented received the six-day iCCM training. HEWs in 87% of health posts in these areas reported receiving at least one supervision visit related to iCCM in the previous three months, with 85% of iCCM health posts received supervision that included register review or observation of patient consultations. In addition, 58% of HEWs received instruction in iCCM clinical practice at a health center in the same time period. Quality of care assessed in iCCM areas through direct observation was variable. Most children (81%) seen at iCCM health posts were assessed for the presence of cough, diarrhea, fever, and malnutrition, though fewer (62%) were assessed for all four general danger signs. HEWs in iCCM

areas correctly classified 53% of children for all major iCCM illnesses (respiratory illness, diarrhea, malaria, measles, and malnutrition) and correctly treated or referred 64% of children for these illnesses.[63]

Though implementation of iCCM likely improved geographic access to curative child services in many rural areas of the country, challenges in care-seeking behavior likely limited the coverage of iCCM services and benefits of the program. A key informant noted that community behaviors challenged iCCM implementation since *"usually people do not want to take their child to the health facilities because they think that it is a waste of time and money."* A cluster-randomized study conducted in 2012 assessed the effect of iCCM implementation on care-seeking and treatment of U5 illness and mortality in 31 woredas in Oromia. It found that while iCCM implementation was overall strong in intervention areas, the program did not significantly increase care-seeking for and appropriate treatment of pneumonia, diarrhea, or fever in children under 5. Likewise, while U5M decreased by 12.7% in the iCCM implementation area, this decline as well as the difference in mortality decreases between iCCM and comparison areas were not statistically significant.[64]

UNICEF and PATH conducted a literature review on barriers to utilization of HEP services that may have affected care-seeking at health posts noted above. It found that care-seeking was likely limited by poor knowledge of caregivers about symptoms and danger signs of childhood illnesses, traditional beliefs, and lack of awareness about services offered by HEWs. Though provision of curative child health services at the community level improved access to these services, geographic and financial challenges in accessing health posts remained in some areas.[65]

The 2014 ESPA+ identified high availability of iCCM but ongoing gaps in capacity and provision of iCCM at health posts across Ethiopia. Availability of curative care services for children under 5 was very high, with 96% of health posts providing these services. However, direct observation of consultations with sick children found that providers assessed all danger signs in only 43% of cases observed at health posts. Treatment rates varied with condition. 25% of children with cough or other upper respiratory illness were referred to higher facilities, while 11% were given antibiotics in alignment with guidelines. Of children diagnosed with malaria (through RDT, microscopy, or clinical assessment), only 17% received antimalarial drugs. Provision of ORS was higher – all children with any diarrhea without dehydration were given ORS. However, none were given zinc. Treatment may have been affected by low availability of essential medicines. At health posts offering curative care services for sick children, ORS was the most highly available drug (90%). However, only 37% of health posts were found to have zinc tablets in stock. Just over half (53%) of health posts had ACT available. Availability of antibiotics was low, with only 23% of health posts having amoxicillin in stock.[30]

ADAPTATION DURING IMPLEMENTATION

The FMOH implemented a number of adaptations to the iCCM program, some of which addressed challenges noted above. Introduction of the HDA cadre into the HEP in 2011 helped strengthen HEP activities, including iCCM, by increasing uptake of services through demand generation and linking community members and HEWs. These volunteers engaged in community engagement to improve utilization of services and strengthen ownership of health.

In response to stock outs, the iCCM program transitioned from use of a "push" system to that of a "pull" system. Following this transition and integration of child health into the main country's integrated logistics and pharmaceutical system, HEWs themselves requested drugs and other supplies from the health center every two months based on consumption data. According to a key informant, this adaptation minimized drug wastage, improved access to drugs at the health post level, and improved equity.

At the time of the widespread introduction of iCCM, care-seeking for sick newborns for iCCM's services was limited. As described in further detail in the Management of Neonatal Sepsis section of this case study, the FMOH launched the national CBNC program in March 2013 in collaboration with UNICEF, L10K, IFHP, and Save the Children. The program aimed to improve antenatal, intrapartum, postnatal, and newborn care by strengthening the PHC unit approach and the HEP. It scaled up community-based maternal and newborn health services in several areas. The program was implemented in two major phases. Phase I was implemented in all woredas of seven zones in the Amhara, Tigray, Oromia, and SNNP regions, again selected due to the strength of the zones' health systems. Phase II of the program was launched in January 2015 with the intention of ensuring national coverage. A midline assessment was conducted in November 2015. Four hundred and twenty-eight (428) young infants were treated across 240 health posts over a period of three months. High rates of adherence to protocols were seen for less complicated cases – 95% of infants classified as having a local bacterial infection were treated with amoxicillin and 100% with dehydration were provided with ORS and zinc.[66] However, quality was lower for more complex cases including management of possible bacterial sepsis of newborns, an area of innovation in Ethiopia included in their iCCM program. CNBC protocol treatment of neonates with severe bacterial infection by HEWs includes pre-referral doses of antibiotics, which was done in 94% of infants.

SUSTAINMENT

The iCCM program has a high degree of sustainability due to its integration into the packages of the HEP, which is a core activity of the HSTP(2015/16 – 2019/20).[44] By 2016-2017, the program grew to be provided in 99.4% of health posts in rural and pastoral woredas across the country.[54] When asked about the current status of iCCM in Ethiopia, a key informant noted:

> *"Currently, if you go to the administrative records, almost all health posts provide iCCM services; even pastoralist regions wherever the health post exists, these health posts are staffed with health extension workers, the health extension workers have been trained on iCCM. So they provide iCCM services, it is universal."*

In addition, according to a key informant, though the iCCM program was previously supported at the woreda level by many implementing partners, planned phase-out of implementation by partners began recently to increase government ownership and sustainability.

Table 13: iCCM implementation strategies and outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Adaptation of existing guidelines Expansion to include major CODs, including neonatal sepsis	iCCM was appropriate given the high burden of malaria, diarrhea, and pneumonia in Ethiopia at the time of the program's introduction
Acceptability	Prior implementation of HEP providing community-based services Delivered by HEWs, who are residents of the communities they serve and selected by communities Involvement of key stakeholders in development and implementation	(-) Lower care-seeking (9%) from HEWs compared to higher-level public facilities (16%) in 2013[67]
Feasibility	Integration into existing HEP • Over 34,000 HEWs deployed prior of iCCM program[37] Decentralized supply chain Initial introduction in four regions Collaboration with implementing partners already working in implementation areas Integration into HMIS	(+) By 2014, • Nearly 30,000 HEWs in 8 regions participated in iCCM • iCCM implemented in 86% of districts nationally[62] (+) High availability of curative child services at health posts (96%) per 2014 ESPA+
Effectiveness and Coverage (Reach)	Integration into HEP serving rural areas Adaptation to meet needs of neonatal mortality	(-) Care-seeking behavior impacts utilization and coverage of iCCM services
Fidelity	Standardized national curriculum within HEW training program Utilization of supportive supervision	(-) A 2012 study found that HEWs in areas implementing iCCM correctly classified 53% of children for all major iCCM illnesses. Similar gaps in quality were reported by the 2014 SPA.
Cost		A 2012 study found that the total iCCM cost per HEW was $237. The economic cost per treatment was $12.40, higher than many of the other countries in the study but still lower than Ghana.[68]
Sustainability	Integrated into HEP, a key activity of the HSTP (2015/16-2019/20) Inclusion in pre-service training for HEWs National protocols Development led by FMOH Gradual planned phase out of implementing partner run programs integrating into national	
Equity	Implementation in all regions	

4.1.3 Other Diarrhea Interventions

4.1.3.1 Oral Rehydration Solution and Zinc

Table 14: ORT and Zinc Key Implementation Strategies

Implementation Strategies
• Following international recommendations • National policy and planning • Data use for prioritization • Integration into existing programs • Utilization of CHWs • Public-private partnership • Community engagement • Rapid scale-up • Supportive supervision

EXPLORATION

In 1978, WHO adopted oral rehydration solution (ORS) as its primary tool recommended for treatment of diarrhea.[69]

Prior to the study period, ORS was very underutilized in Ethiopia. The DHS reported that in 2000, only 13.1% of Ethiopian children under 5 with diarrhea received oral rehydration therapy (ORT) from an ORS packet, one of the lowest rates of child utilization of ORS amongst low-income countries. Children were more likely to be given increased fluids (35%) rather than ORS, though 39% of children received no treatment for diarrhea. Knowledge about ORS was variable but higher than use. There was also inequity – 60% of women in the poorest wealth quintile versus 87% of women in the richest quintile reporting having heard about ORS.[70]

In 2004, WHO and UNICEF released a joint statement recommending use of zinc supplementation for 10-14 days alongside ORS use following demonstration that supplementation during an episode of acute diarrhea reduces both duration and severity of the episode.[71]

PREPARATION

Ethiopia decided to incorporate ORS and zinc into the facility-based IMCI and iCCM in 2000 and 2010, respectively. Due to this integration, health workers were trained to provide ORS and zinc at primary care and higher-level health facilities, while HEWs were trained to provide this care at the community-level at the lower level health posts.

See “Preparation” sections for Facility-Based IMCI and iCCM for further details.

IMPLEMENTATION

ORS and zinc were expanded through facility-based IMCI in 2000, with scale-up reaching all regions beginning the following year. This program includes facility-based management of diarrhea, including treatment with ORS and later also zinc, as a main component (see section on FB-IMCI).

Prior to 2007, the HEP only provided preventive services and community-based provision of ORS and zinc was not available.[59] Diarrhea treatment for children under 5 by HEWs, consisting of provision of ORS, began in 2007 as part of what would become the national iCCM program three years later.

The 2011 DHS reported a doubling of children with diarrhea receiving ORS from a packet from 2000 from 13% to 26% but still overall low utilization. A higher percent (40%) received either ORT (including ORS or recommended home fluids) or increased fluids. Children residing in rural areas were more likely (45%) to receive ORS than those in rural areas (29%). Utilization of ORS varied by region from 45% in Gambella to 24% in Oromia but underutilization persisted countrywide.[72]

The 2014 ESPA+ evaluated capacity and provision of IMCI services, including management of diarrhea, in facilities across the country. In facilities above health posts, adherence to the national guidelines remained a challenge as many health providers were inclined to prescribe antibiotics rather than the protocol-defined ORS and zinc alone to children with diarrhea. A remarkably high 81% of children with diarrhea without dehydration and 80% of those with diarrhea with dehydration were prescribed antibiotics, higher than provision rates for ORS (29% and 66% respectively). Provision of zinc was even lower in both groups (8% and 16% with and without dehydration respectively). In health posts, adherence to guidelines for ORS was much higher, given to all children presenting with diarrhea, but in contrast zinc was never given. Barriers identified included recent training, with only 7% of interviewed non-HEW child health service providers in facilities reported receiving training on diarrhea diagnosis or treatment in the 24 months preceding the survey, compared to 43% of HEWs. A key informant explained that while this lack of training may be affected by rotation and turnover of staff at health facilities, the actual coverage of training was likely higher as management of diarrhea is included in IMCI and iCCM trainings and is part of in-service education.[30]

Coverage was also affected by community perceptions of diarrhea and acceptance of ORS and zinc. In Ethiopia, many caregivers did not bring their children with diarrhea to the health center to receive ORS and zinc due to the perception that diarrhea is not a serious or life-threatening disease. For children that did visit health facilities and were prescribed ORS and zinc, a key informant noted that the unpalatable taste of ORS and long, 14-day recommended regimen of zinc were also believed to impact adherence. Discussing contributing factors to low ORS coverage in Ethiopia, another key informant explained that many providers prescribe antibiotics rather than ORS and zinc:

> *"There could be the providers' attitude [to] treat with antibiotics, maybe that could be an issue. The other is when we look the perspective of caretakers may force or pressure the prescriber to prescribe antibiotics [rather] than ORS because ORS is not considered as a*

medicine so this may be one issue for the underutilization of ORS and zinc but over prescription of antibiotics for under-5 children with diarrhea."

In response to the results, work was done to address both demand and supply barriers. A number of community education and engagement activities were implemented in response to this low utilization. From the start of the iCCM program, HEWs and HDA volunteers have used promotional community-level activities to counsel mothers on prevention and treatment of diarrhea, though these activities required strengthening. In 2015, the FMOH partnered with DKT Ethiopia to release print materials, including fliers and posters, promoting ORS and zinc across the country. All households in the country were also provided with a Family Health Guide booklet, a national guide translated into local languages instructing caregivers on how to identify diarrhea, seek care, and treat it. That same year, the FMOH began using televised promotion of ORS and zinc throughout the country to increase knowledge and uptake through messages translated into local languages.

Stockouts improved with the Ethiopia Service Availability and Readiness Assessment (SARA) conducted in 2016 which reported ORS to be the most available essential medicine in facilities surveyed, though availability was still far from universal. ORS was available at 55% of facilities, excluding health posts. Availability of zinc was lower at 33%. Availability of both drugs ranged widely by region with lowest rates of both in Harari – ORS availability ranged from only 34% in Harari to 81% in Somali and zinc availability ranged from 0% in Harari to 72% in Somali. Availability of ORS and zinc was similar in health posts (49% and 31%, respectively) as in the higher-level facilities.[73]

The 2016 DHS reported that knowledge about ORS packets for the treatment of diarrhea had increased to two in three women (66%) ages 15 to 49, although reported care-seeking and treatment remained low with ORS and zinc. Only 30% of children with diarrhea in the two weeks preceding the survey received ORS with higher rates in urban versus rural areas (41% versus 28.3%). Utilization of ORS for treatment of diarrhea continued to vary by region, ranging from only 23% in Oromia to 56% in Addis Ababa. 35% of children with diarrhea during this period were reported by their mothers to have received zinc and only 17% received both ORS and zinc.[34]

Use of ORS improved modestly across all wealth quintiles from 2005 to 2016 but remained low even for the wealthiest and the equity gap remained. Use in 2005 was very low in the poorest quintile (14%) and more than twice as high in the wealthiest (37%). In 2016, use of ORS had increased, with the lowest rates in the 4th quintile (23%) and the highest in the wealthiest quintile (41%). Though the gap between the wealthiest and all others has narrowed slightly, improvement is needed across quintiles.

ADAPTATION DURING IMPLEMENTATION

The increased focus on community education and adaption of the family booklet were done to address low uptake.

SUSTAINMENT

Despite ongoing challenges in attaining high coverage, ORS and zinc remain sustainable interventions for management of diarrhea due to their integration into facility-based IMCI through higher level facility-based care and into iCCM as part of the country's flagship HEP.

A key informant noted that an ongoing challenge in attaining high ORS and zinc coverage and area for future work is the growing role of the private sector in diarrhea treatment and use of antibiotics a private facilities, explaining:

> *"According [to] the EDHS report, a considerable number of kids with diarrhea – like 15% or 20% – are going to the private facilities and the contribution of the private health sectors has been gradually increasing. We can no more ignore the role of the private facilities in the case management of under-5 diarrhea. We have not done much about it and here most of the antibiotic administration for under-5s is undertaken in the private health facilities and that is an area to be explored. We need strong partner support for the ministry and the regional health bureaus and I can say that it is a big project and it is a tricky one working with the private health sectors. Working with private health sectors is very tricky."*

After the study period, the FMOH began transitioning to a system of distributing co-packed ORS and zinc to facilities to address stockouts and provider adherence to co-management guidelines that affected coverage of ORS and zinc. A key informant explained that co-packing began in selected zones with high caseloads of U5 diarrhea. Expansion was planned for two phases to ensure existing stocks of loose ORS and zinc are utilized prior to full, national scale-up.

Table 15: Oral Rehydration Therapy and Zinc Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness		High burden of diarrheal disease in children under 5
Acceptability	Community engagement activities through HEP and mass media Treatment at community level by HEWs Public-private partnership to produce educational materials on ORS and zinc Integration into Family Health Guide	(-) Ongoing community perception of diarrhea as disease not requiring care at a health facility (-) Low uptake although slight increase towards the end of the study period
Feasibility	Inclusion of ORS and zinc into IMCI and iCCM guidelines and training Utilization of existing HEP Inclusion in facility essential drug list	(-) Low availability of ORS and zinc at health facilities, although some increase by the end of the study period and high rates of ORS (+): High availability of FB-IMCI and iCCM services at facility levels

		(-) Variable rates of recent provider training (possibly underestimated due to pre-service training)
Effectiveness and Coverage (Reach)	National policy and standard for provision of ORS and zinc at all facility levels and community level, based on international recommendations Use of HEWs to provide ORS and zinc (integration)	(-) 2014 – ORS given to only 29% of children with diarrhea without dehydration and 66% of those with dehydration treated at health facilities excluding health posts and zinc given to only 16% and 8%, respectively (+/-) Higher coverage of ORS at health posts (100%), but no administration of zinc (-) Per key informant, growing proportion of diarrhea cases treated in private facilities but tendency to prescribe antibiotics rather than ORS and zinc at these facilities, requiring future efforts to address treatment in the private sector
Fidelity	Inclusion of ORS and zinc into IMCI and iCCM guidelines Training (pre- and in-service) Supportive supervision for IMCI and iCCM programs	(-) Low rates of providers receiving in-service training on diarrhea diagnosis and treatment in 2014 – 43% in health posts and 7% in all other facility types (-) Low provider adherence to national guidelines and preference to prescribe antibiotics in facilities, varying use of zinc
Cost	Not found	Not found
Sustainability	Integration into IMCI and iCCM programs (HEP)	(-) Challenges with maintaining stocks
Equity	Translation of Family Health Guides into local languages Free provision	(+) Remaining inequities in coverage – per KI, possibly due to higher health literacy and access in urban areas, as well as cultural practices in rural areas: *"We come to the cultural or traditional practices, the more rural I would say people may stick to the tradition and avoiding that meal or this meal and giving that tradition-based intervention…"*

4.1.3.2 Rotavirus Vaccination

Table 16: Rotavirus Vaccination Key Implementation Strategies

Implementation Strategies
• Adoption of global evidence on effectiveness • Data-based decision-making • Local data generating and surveillance • Rollout plans reflecting other priorities • Donor coordination and engagement • Leveraging donor resources

- Government co-financing
- System strengthening
- Informed by existing data
- Integration into existing programs, including vaccination, HEP, and PHC
- Adaptation of global training and assessment resources
- Training (decentralized and standardized)
- Supportive supervision
- Planning for scale from the start
- Rapid scale-up
- Outreach activities through media and social mobilization for community for education, sensitization, and vaccination utilizing HEWS
- Addressing geographic access through HEWs and mobile immunization
- Social mobilization and media activities for community education and sensitization

EXPLORATION

In 2008, Ethiopia contributed 6% (28,218) of deaths globally due to rotavirus-related diarrhea. The FMOH conducted rotavirus surveillance supported by WHO from August 2007 to 2009. This surveillance, which took place at Tikur Anbessa Specialized Hospital in Addis Ababa, identified confirmed rotavirus in 27% of children under the age of 5 hospitalized with acute diarrhea.[74]

The WHO released a recommendation for universal rotavirus vaccination in 2009.[75] Following this announcement, the Global Alliance for Vaccines and Immunization (GAVI) began offering financial support to 33 countries to aid introduction of the vaccine.[76] The FMOH's immunization TWGs, which included members from the FMOH and organizations such as WHO, UNICEF, the US Centers for Disease Control and Prevention (CDC), the Clinton Health Access Initiative (CHAI), and USAID, used local published surveillance data as well as global evidence on rotavirus and expert recommendations to consider introduction of the rotavirus vaccine (RTV). One key informant from the FMOH described the process of deciding to introduce the RTV, stating

> *"when we look into the incidences like the disease and the role of rotavirus in the diarrheal disease, there are experts here and we have different experts, we consulted [Addis Ababa University], the clinicians, and pediatricians. So it will go through different consultations and when we have technical working group in the ministry… the team looks on the references, the position papers about rotavirus, the sage recommendations on that issue and contextualizing as well as understanding the magnitude of the problem."*

Following this work by the TWG, Ethiopia's Inter-Agency Coordinating Committee, led at the time by then-State Minister Dr. Kebede Worku, made the final decision to apply to GAVI for support to introduce the RTV.

PREPARATION

In 2011, the Government of Ethiopia applied for financial support from GAVI for implementation of the RTV on a 2-dose schedule, with introduction planned for March 2012. The proposal, which was approved

in September 2011, required the government to co-finance introduction at $0.20 per dose with no annual increase. The government anticipated co-financing approximately $5.2 million USD of the total $127.4 million USD total vaccine cost over a period of four years.

In 2009 Ethiopia's Vaccine Management Assessment was utilized by FMOH to evaluate and improve the country's vaccine infrastructure. This assessment identified areas such as buildings, cold chain equipment and transport, and vaccine storage temperature components as gaps which would limit introduction of any new vaccines including rotavirus. Following the assessment, the government carried out activities at the national, regional, district, and health facility levels to improve cold chain capacity. Due to these efforts, Ethiopia's vaccine storage capacity at the central and primary levels was already sufficient to accommodate introduction of the RTV at the time of the country's support request to GAVI. Vaccines were distributed to all regions one month prior to initial introduction of the RTV. They were then distributed from regions to zones, districts, and health facilities.

A social mobilization and communication plan led by a sub-technical team within the FMOH and supported by partners such as WHO and UNICEF was developed and implemented to support RTV introduction and increase demand. A media campaign featuring information, education, and communication (IEC) materials began weeks before introduction of the vaccine. This included both roundtable talks on television and radio and radio spot messages to raise awareness of the vaccine among policy- and decision-makers. In addition, HEWs communicated these messages across the country at the community level.[77]

IMPLEMENTATION

Ethiopia's introduction of the RTV was initially planned to take place in 2012. The RTV was added to the country's national immunization schedule as part of the Expanded Program on Immunization (EPI) in 2013.[78] Roll-out was delayed to later the same year for a number of reasons, including a global shortage of the preferred 2-dose presentation as well as overlapping vaccine activities in Ethiopia in 2013 that affected capacity.[79]

Training of health workers, cold chain storage managers, and EPI managers was carried out prior to vaccine introduction. Due to the Ethiopia's large geographic size, training was conducted in a cascading approach with standardized training materials adapted from WHO in order to ensure uniformity across the country. Following a national-level "master" training of trainers (TOT) including participants from all regions and partners, the training was cascaded down through regional and facility-level TOT. In addition to background information on rotavirus burden, transmission, and risk of infection, training topics included vaccine presentation (2-dose), handling, storage and transportation, administration, and efficacy and safety. The FMOH also utilized supportive supervision and on-the-job training at health facilities to further support vaccine introduction.[77]

On November 7, 2013, Ethiopia became the 17th GAVI-eligible country to introduce the RTV nationally. The vaccine was introduced in all regions except the Somali Region at that time due to an active polio outbreak response in the region.[80] As one of the vaccines included in the national immunization schedule

for infants, the RTV was administered at most health facilities. A 2012 EPI cluster study found that 97.1% of urban health facilities and 89.2% of rural health facilities, including health posts, surveyed provided routine immunization services, including rotavirus, on a regular basis. Standard outreach services by health workers, including HEWs, were also provided for communities located at least 5km from these health facilities.[78] The EPI utilized approaches such as Reaching Every District and Sustainable Outreach Services to ensure high immunization coverage throughout the country and particularly in areas of the country with limited access to static health facilities. Per a key informant, in many regions of the country, static immunization services at health facilities had *"very low, minimal coverage, so most of the services, especially immunization services, are provided through outreach services."*[81]

After a delay of nine months, the RTV was introduced into the Somali Region in August 2014.[82] Mobile vaccination services for rotavirus were utilized for Somali and well as Afar due the regions' large surface areas and scattered population.

The FMOH's HSDP IV (2010/11-2014/15) identified a "best case scenario" target rotavirus immunization coverage rate of 90% by 2014/2015. The WHO and UNICEF estimated a lower rate of coverage for receiving both doses of the vaccine was 56% in 2014 and 79% in 2015. The first year after introduction of the RTV, coverage was comparable to that of other routine childhood vaccines. By 2015, rotavirus-2 coverage actually surpassed than these other immunizations, despite being introduced more recently (See Figure 22).[83]

The 2016 DHS showed large regional variation of coverage of two doses of the RTV similar to disparities seen for other routine vaccines in Ethiopia. Coverage was lowest in Afar, where only 23% of children received two doses of the vaccine despite mobile immunization and outreach work in the region. It was highest in Addis Ababa, with a coverage of 92%. The DHS also revealed notable drops between the first and second doses – overall coverage was 64% for the first dose but 56% for the second, lower than estimates by both the FMOH and WHO/UNICEF.[2]

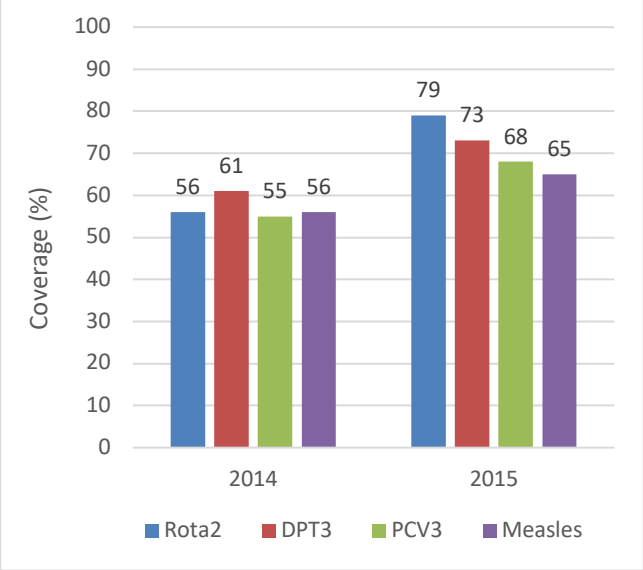


Figure 20: WHO/UNICEF Estimated Immunization Coverage in Ethiopia, 2014-2015

Commenting on these regional differences in coverage, a key informant noted,

> *"overall when we look at coverage there are huge inequities by the way, in Afar, Somali, Gambella, and Benishangul-[Gumuz] when we compare with Amhara, Addis Ababa, Tigray, and Oromia there is a huge discrepancy. One thing is the system strength, the system in Afar, Somali, Gambella, and Benishangul-[Gumuz] is very weak, even we have a platform to support for these regions but we could not able to manage and avert the difference."*

ADAPTATION DURING IMPLEMENTATION

Not found

SUSTAINMENT

The integration of RTV was designed to support sustainability. It was included in the country's current immunization schedule for infant, with doses recommended at six and 10 weeks after birth, timed to be administered with other routine vaccinations. EPI record keeping and reporting formats, including child immunization cards, tally sheets, registration books, supervision checklists, and reporting formats for the national HMIS system were updated to include the RTV. The RTV was again featured in the FMOH's subsequent Comprehensive Multi-Year Plan (cMYP) 2016-2020.

In 2014, the Government of Ethiopia requested an extension of its new vaccine support from GAVI for the years 2016-2020.[79] The total expected cost of activities for new vaccines, including the RTV, during this time period was $514 million USD. The government was expected to continue to co-finance these activities at $0.20/dose. Its total co-financing payment was estimated to total $8,856,000 over the period of 2015 to 2020.[79]

The WHO estimates that immunization coverage for receiving two doses of the RTV remained stable at 79% in 2015 and 80% in 2017.[84] Despite not achieving the last target, the cMYP 2016-2020 has set a higher target coverage of 97% in 2020.[78]

Table 17: Rotavirus Vaccination Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Surveillance data identifying rotavirus in 27% of children U5 hospitalized with acute diarrhea at Tikur Anbessa Specialized Hospital prior to introduction Adoption of global evidence on effectiveness	(+) Vaccine prioritized and introduced within three years of available funding
Acceptability	Utilization of social mobilization and communication plan featuring IEC materials, including: • Round table talks (television, radio) • Radio spot messages[79] • Use of HEWs	No evidence of rejection by the community
Feasibility	Expansion of cold chain capacity prior to vaccine roll-out[79] Integration of vaccine indicators in newly introduced HMIS	(+) Available in all regions as planned and stocked (+) Outreach activities conducted

	Integrated into EPI routine schedule for infants Integrated into the national strategy and timing of vaccinations Cascaded and standardized training and adaptation of global training and assessment resources	
Effectiveness and Coverage (Reach)	Rapid national scale Use of outreach campaigns to reach remote and unserved communities more than 5 km away from health facilities Training in vaccination and vaccine management	(+) UNICEF/WHO coverage estimates of infants receiving the 2nd dose of RTV: • 2014 – 56% • 2015 – 79%[11] (-/+) The 2016 DHS reported: • Overall coverage of 64% for 1 dose and 56% for 2 doses of RTV • Regional variation in coverage – from 23% in Afar to 92% in Addis Ababa for 2 doses • Higher coverage in urban areas compared to rural ones (79% and 53%, respectively, for 2 doses) (+) 18% reduction in proportion of diarrhea hospitalizations due to rotavirus in children under 1 year, decline in seasonal peaks of disease[85]
Fidelity	HR strengthening through training and supportive supervision Integration into routine vaccine cards and schedule	
Cost	$127.4 million USD over four years	
Sustainability	Integration into existing EPI infant vaccine schedule Extension of GAVI support through 2020[77] cMYP 2016-2020 set target coverage of 97% in 2020[78] National contribution of funding Integration into national strategy and HMIS and routine vaccine schedules Leverage existing vaccine delivery system	(+) Sustainment or increase in rates with UNICEF/WHO estimated coverage increased to 80% in 2016 and 2017[86] (+) Integrated into national EPI program
Equity	Free immunization services Outreach and mobile efforts to reach geographically challenged areas	(-) Remaining inequities in coverage (see Effectiveness and Coverage (Reach) section above)

4.1.4 Other Pneumonia Interventions

4.1.4.1 Pneumococcal Vaccination

Table 18: Pneumococcal Vaccination Key Implementation Strategies

Implementation Strategies
• Stakeholder engagement • Data use for decision-making and prioritization • Local data generation • Government co-financing • Leveraging donors and partner resources • System assessment and strengthening • Adaptation for local context • Training and supportive supervision (cascaded) • Community engagement • Integration into existing program • Outreach activities • Monitoring and evaluation • Use of catch-up strategy

EXPLORATION

Vaccination with the pneumococcal conjugate vaccine (PCV) has been shown to be effective in reducing U5 deaths from severe forms of pneumococcal disease, including pneumonia and meningitis. In 2005, WHO estimated that pneumococcal disease resulted in 700,000 to 1 million deaths in children under the age of 5 each year. It released a position paper in 2007 recommending prioritization of the inclusion of PCV-7 in national immunization programs, especially in countries with U5M of over 50/1,000 live births.[87]

In 2009, GAVI, the World Bank, and other donors launched the Pneumococcal Advance Market Commitment with the objective in assisting countries access more affordable pneumococcal vaccines. This initiative features a variety of partners providing fiduciary (World Bank), financial (Italy, the United Kingdom, Canada, Russia, Norway, GAVI, and the Bill & Melinda Gates Foundation), technical (WHO), and logistical (UNICEF) support in order to support vaccine introduction in 45 countries by 2015 through the Advance Market Commitment.[88]

It was already known in Ethiopia that vaccine preventable infections including pneumococcus represented a higher burden. A study of children between ages of 3 months and 12 years admitted to a tertiary hospital in Addis Ababa with meningitis between June 1996 and May 1997 found that *H. influenzae*, *S. pneumoniae*, and *N. meningitidis* comprised 90% of culture isolates from meningitis cases. Infants accounted for 58% of included cases and 68% of deaths in this study, reflecting a significant burden of morbidity and mortality.[89]

PREPARATION

In 2007, Ethiopia's immunization Inter-Agency Coordination Committee began discussing pneumonia prevention and PCV. In February 2007, a series of Inter-Agency Coordination Committee meetings were held to discuss topics such as need for introduction, feasibility, cold chain storage, vaccine selection, and time of introduction.

The FMOH soon expressed interest in introducing the vaccine. Following the meetings, the FMOH wrote a letter of intention to introduce PCV10 by January 2010. At the time of the introduction of PCV, per the FMOH, *Streptococcal pneumoniae* infections were the leading cause of pneumonia, an illness that accounted for up to 28% of all deaths among children under 5 in Ethiopia. Approximately 80% of the burden of pneumococcal disease in the country was caused by the 10 serotypes contained in the 10-valent PCV, leading to the decision for PCV-10 instead of PCV-7. Introduction of PCV in Ethiopia was therefore estimated to avert 35,000 deaths in one birth cohort over a period of five years.[90]

The Inter-Agency Coordination Committee then established a pneumococcal vaccine introduction task force to prepare the vaccine introduction plan, as well as a request for GAVI financial support to aid implementation. The government submitted this request to GAVI support in September 2009, which was approved in July 2010. Under this agreement, the PCV vaccine was co-financed by the government, beginning with $0.20/dose minimum co-financing the first year followed by $0.30/dose for the remaining four years of GAVI support. Over the course of five years, the government was expected to co-finance a total of about $13.4 million of supplies (vaccine doses, AD syringes, and safety boxes) and GAVI would provide approximately $341 million for the same supplies.[91]

At the time of Ethiopia's request for support, PCV 7, 10, and 13 were available through GAVI. Although PCV13 was preferred by stakeholders as it offered coverage of additional strains, selection of PCV13 rather than PCV10 was anticipated to delay vaccine introduction. Therefore, the country chose to adopt PCV10 in order to save additional lives through earlier implementation while also covering more of the pneumonia-causing strains in Ethiopia than PCV7 as noted above.[92]

National cold chain inventory assessment conducted by WHO in 2008 indicated that upgrading the central cold room storage, the country's available cold chain storage space at all levels, was necessary for adequate accommodation of the introduction of PCV by late 2010.

In preparation for vaccine introduction, the country also conducted a variety of pre-introduction activities, which were funded by WHO and UNICEF in addition to GAVI. Comprehensive training materials were prepared by the FMOH in a process led by the Training Subcommittee in order to standardize training countrywide. In particular, a training manual focused on best practices and handling information for PCV was adapted from the WHO introduction handbook for PCV for use by EPI managers and health workers. This manual was also abridged for use by HEWs and was accompanied by a training video.

PCV was added to the EPI existing infant vaccine schedule. The FMOH recommended that infants be given three doses of PCV at 6, 10, and 14 weeks of age, alongside the pentavalent vaccine.

The FMOH developed a comprehensive advocacy and communication plan to support PCV introduction. This plan consisted of advocacy, social mobilization, and program communication activities across the regional, zonal/woreda, and health center/health post. Anticipated benefits of this strategy included creation of awareness and demand for the vaccine, reduction of dropout rates and improved immunization schedule follow up, detection and reporting of vaccine adverse events, and creation of community support for the program. [93]

IMPLEMENTATION

PCV-10 was introduced countrywide in Ethiopia in November 2011 as a routine vaccination included in the national immunization schedule. As a catch-up strategy unique to this particular vaccine, all children in the country under the age of 1 year were eligible to receive PCV. The vaccine was given through routine vaccination at health facilities and health posts (by HEWs) as well as outreach campaigns (Supplementary Immunization Activities [SIAs]).[94]

Due to Ethiopia's large size, training of health workers, cold chain store keepers, and EPI managers was conducted in a cascaded approach. Two-day trainings were conducted for staff of RHBs, health departments, and woreda health offices. Hospital and health center staff were also trained for two days, with a minimum attendance of two staff from each facility. Trained health facility staff were required to brief other staff at their facility after the training. All HEWs were required to attend a one-day training.

Supportive supervision was also used during implementation to reinforce initial training of involved staff. Woreda EPI focal persons provided supervision for each health center as well as HEW supervisors. All supervisors were advised to place additional emphasis on immunization activities for the initial six months following introduction. Supportive supervision visits allowed supervisors to review monitoring data, vaccine handling and injection practices, social mobilization, logistics, and stock management at facilities providing PCV.[93]

The FMOH relied on ongoing internal evaluation to identify and address challenges and successes of vaccine introduction. It requested monthly reports from each sub-regional level, which were compiled by the regions and submitted to the central level on a monthly basis. These reports included information on successes and challenges of implementation and utilization of PCV compared with the pentavalent vaccine. During introduction, review meetings were scheduled to occur quarterly at the zonal and woreda level and every six months at the regional level. These review meetings were intended to include participants from FMOH departments (Pharmaceutical Fund and Supply Agency [PFSA], HMIS/Planning, Health Promotion/Disease Prevention) as well as partner organizations involved in implementation (Ethiopia IFHP, WHO, UNICEF) and follow the same format as monthly reports. In addition, programmatic evaluations were planned for one, six, and 12 months after vaccine introduction. These evaluations, conducted by the FMOH, were intended to supplement evaluations at the woreda and regional levels. A national review meeting was also scheduled to occur after introduction.[93]

The country's EPI cMYP 2011-2015 set targets for third dose PCV coverage – 88% in 2011, 92% in 2012, 95% in 2013, and 96% in 2014 and 2015.[78] WHO/UNICEF estimated that these targets were not met, with estimated coverage during these years of 12%, 38%, 63%, and 76%, respectively. However, official coverage reported by the FMOH was much higher and even reached the cMYP goals in 2016, when coverage reached 96%.[78]

The 2016 DHS found lower coverage than these estimates in 2015, reporting that only 49% of children ages 12 to 35 months received the third dose of PCV. It showed significant drop-out between the first (67%), second (61%), and third (49%) doses of the vaccine. Many demographic differences were also reported. PCV3 coverage was higher in children residing in urban areas (73%) compared to those living in rural areas (46%). Regional variation of PCV3 coverage was also seen, with coverage highest in Addis Ababa (91%) and Tigray (78%) and lowest in Afar (18%), likely related to challenges in regional coverage noted in the RTV section. As commonly seen in coverage of other vaccines, differences in equity were also reported despite free immunization services, with coverage also differing by wealth – only 36% in the lowest quintile but 76% in the highest received three doses of the vaccine.[2]

ADAPTATION DURING IMPLEMENTATION

No record found but active monitoring and evaluation was ongoing for implementation adjustments.

SUSTAINMENT

The cMYP 2016-2020 emphasizes continued increases in PCV coverage, with a target of 97% third dose PCV coverage in 2020. It also lists establishment of a pneumococcal disease surveillance system by 2020 as a national objective.[78]

In 2014, the Government of Ethiopia applied for extension of the country's new vaccine support for PCV by GAVI. This program extension was designed to provide additional GAVI funding for PCV activities through 2020, with the government co-financing $0.20 per dose the entire period.[79] In 2018, the government co-financed $920,000, or 300,000 doses, for PCV activities.[92]

Table 19: PCV Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy (all vaccine)	Evidence
Appropriateness	Data use to understand disease burden	(+) PCV introduction reflected high pneumococcal disease burden (top cause of pneumonia in Ethiopia) (+) 80% of pneumococcal disease was caused by serotypes covered by PCV10, leading to introduction of that presentation rather than PCV7
Acceptability	Utilization of advocacy, social mobilization, and program communication at regional,	(+): High levels (nearly 100%) of general acceptability of vaccines in the community, according to interviewees in a 2015 study[92]

	zone/woreda, and health center/post levels through stakeholder engagement, including: - Meetings with regional bureaus, religious institutions and leaders, Non-governmental organizations (NGOs), school leaders, and women and youth groups - Launching ceremony and rally - Messaging for schools, religious, and traditional institutions - Dissemination of short messages and educational programs through mass media	
Feasibility	Expansion of cold chain capacity prior to vaccine roll-out Integration of vaccine indicators in newly introduced HMIS Integrated into routine schedule and concurrent with pentavalent Donor funding and government co-funding	**(+) PCV successfully introduced and no stockouts noted**
Effectiveness and Coverage (Reach)	Local data to understand serotypes and burden of disease Use of outreach campaigns to reach remote and unserved communities Integrated into EPI routine vaccination schedule Catch-up vaccination for children under 1 year during introduction Decision to rapidly implement with PCV10 versus waiting for PCV-13 capacity Training and supportive supervision	(+/-): Increases in coverage for vaccination in all geographic districts and both urban and rural areas but remained below targets (-) Challenges with achieving coverage goals (+) WHO/UNICEF estimates of coverage of PCV3 increasing from 12% in 2011 to 76% in 2015[86]
Fidelity	Training Supportive supervision Close monitoring of implementation Integration of PCV into routine schedule and EPI system	
Cost	Approximately $354 million over five years	
Sustainability	Integration into existing EPI infant vaccine schedule	Integrated into national EPI program and strengthening of surveillance planned

	Extension of GAVI support through 2020 Government co-financing National target of 97% PCV3 coverage by 2020 established by the cMYP 2016-2020[78]	
Equity	Free immunization across regions	(-) The 2016 DHS reported: • PCV3 coverage varied by region, ranging from 18% in Afar to 91% in Addis Ababa • Urban areas (73%) had higher PCV3 coverage than rural ones (46%) • Variable coverage by wealth quintile, ranging from 36% in the lowest quintile to 71% in the highest

4.1.4.2 Haemophilus Influenzae type B Vaccination

Table 20: Hib Vaccination Key Implementation Strategies

Implementation Strategies
• Adoption of global evidence on effectiveness • Local data generation and use • Leveraging donors and partners • System strengthening • Integration into and leveraging of existing systems • Free service • Training and adapting existing training program for local context • Partner engagement • Government commitment to co-financing • Adaptation for local context

EXPLORATION

In 1998, WHO recommended introduction of the *Haemophilus influenzae* type B (Hib) vaccine into national immunization programs of countries with a high Hib burden. An updated position statement released in 2006 strongly recommended introduction of the vaccine into all countries' national immunization schedules, regardless of disease burden.[95]

A study of 136 children with meningitis between the ages of 3 months and 12 years admitted to a tertiary hospital in Addis Ababa between June 1996 and May 1997 found that *H. influenzae*, as well as *S.*

pneumoniae, and *N. meningitidis* accounted for 90% of culture isolates. Infants accounted for 58% of included cases and 68% of deaths.[89]

Tikur Anbessa Specialized Hospital in Addis Ababa began collecting and reporting sentinel surveillance data on bacterial etiologies of pediatric meningitis in 2001 after joining the Pediatric Bacterial Meningitis network. In 2004 this surveillance data found that H. influenzae type B was identified in 44% of a total 107 suspected meningitis cases.[96]

PREPARATION

After discussions between the government and partners, in 2003 the Government of Ethiopia reached the consensus to introduce new vaccines containing Hib and Hepatitis B (HepB) into the routine EPI schedule. The government submitted a request to GAVI in 2005 for support of introduction of a combined DTwP-hepatitis B-Hib B (pentavalent) vaccine. This request was approved by GAVI and the country received an introduction grant of $100,000 USD for the first phase of GAVI support (2000-2005).

In 2005, the government worked with partners to expand the country's vaccine storage space at all levels to support new vaccine introductions. At the central level, four additional cold rooms were procured by WHO and the HIV/AIDS Prevention and Control Office, increasing total central cold room storage capacity to 175 m^3. Approximately 1,400 refrigerators procured with support by UNICEF and the Government of Ireland were distributed to regions, doubling cold storage space at the regional level in 2005.[97]

Prior to introduction of the vaccine, the FMOH updated standard immunization recordkeeping and reporting formats to include the pentavalent vaccine. After finalization, the FMOH distributed the updated immunization cards and vaccination monitoring forms to the regions for distribution to sub-regional levels down to the population and lower facility levels.

The FMOH aimed to introduce the pentavalent vaccine in January 2006. However, as the global supply of the pentavalent vaccine was limited at the time of its GAVI proposal, the government expressed its willingness to delay introduction in favor of introducing the pentavalent rather than quadrivalent vaccine. Although introduction of the pentavalent vaccine was more expensive than introduction of the quadrivalent one, the FMOH believed that the pentavalent vaccine's long-term benefits in covering hepatitis B as well and reduced associated non-vaccine costs outweighed its slightly increased price. Due to a global shortage, the initial supply of the vaccine did not arrive in Ethiopia until December 2006.[98]

IMPLEMENTATION

The pentavalent vaccine was introduced into the EPI in March 2007, replacing the previous Diphtheria-Pertussis-Tetanus (DPT) vaccine. Citing concerns that equity issues could arise from a phased introduction, the government rolled out the vaccine at a national level.[99] It was the first new vaccine to be integrated into the country's existing immunization schedule since its establishment in 1980. Similar to DPT, administration of three doses was recommended to be given to all children at 6, 10, and 14 weeks of age. Introduction of the vaccine did not include a catch-up strategy for children older than 12 months of

age.[74] Following its inclusion in the immunization schedule, the vaccine was administered at public health facilities, including health posts, as well as those supported by non-governmental organizations (NGOs) free of charge.

The FMOH utilized the WHO new vaccine introduction module, which included three main components of the pentavalent vaccine: basic information, practical issues, and logistics and cold chain. The FMOH conducted a master TOT course at the national level. The training was then cascaded down to the regional, zonal, and health facility level for health workers, including HEWs.[97]

At time of introduction, the "Reaching Every District" approach was already utilized in 90% of districts in Ethiopia. The FMOH utilized and expanded this approach to implement the pentavalent vaccine. Activities included micro-planning in all woredas of the country, regular supportive supervision by EPI staff, quarterly woreda-level review meetings and bi-annual regional review meetings, and engaging community leaders.

The EPI and JSI Research and Training Institute conducted a study of 1,181 children from three randomly selected woredas in three regions between February and April 2013 to assess coverage of the pentavalent vaccine. This assessment utilized both immunization coverage surveys and serosurveys to determine coverage and inform the FMOH's evidence-based decision-making regarding strategies to pursue nationwide universal child immunization in Ethiopia. While coverage estimated using administrative records in 2012 ranged from 80 to 90%, coverage estimates using coverage surveys (utilizing vaccine cards, maternal recall, and EPI registers) and serosurveys found that that administrative rates overestimated coverage. Coverage surveys estimated coverage ranging from 29% among infants 6-8 months of age in the Arbegona woreda of SNNPR to 87% among toddlers 12-23 months of age in the Hintalo Wajerate woreda of Tigray. Coverage estimated by serosurvey also varied widely – from 31% in infants in Assaieta woreda of Afar to 93% in toddlers in Hintalo Wajerate.[100]

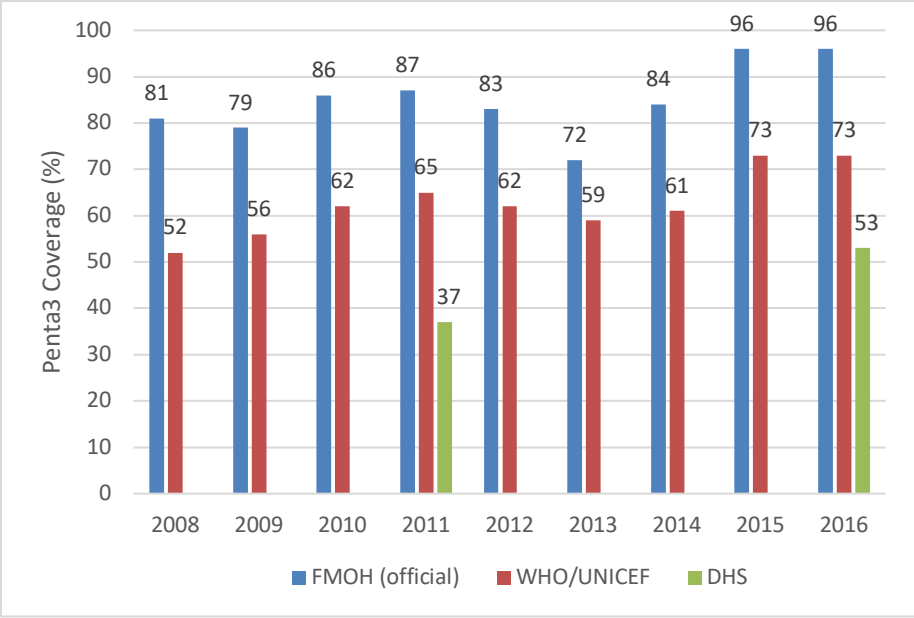


Figure 21: Penta3 Immunization Coverage Estimated by FMOH, WHO/UNICEF and DHS (2008-2016)

This discrepancy was also reflected in differences in coverage estimates between FMOH data and UNICEF/WHO estimates. In FMOH's estimates utilizing administrative data, Penta3 coverage reached 81% by 2008 and

96% by 2015. However, similar to the study above and with other vaccines, WHO/UNICEF estimates of coverage were much lower at 52% and 73%, in 2008 and 2015 respectively (Figure 23), although other countries have found challenges with denominators used in these estimates. WHO/UNICEF estimates also found a drop-out between the first and third doses of the pentavalent vaccine, from 85% for Penta1 to 73% for Penta3 in 2015.[83]

The 2016 DHS also found lower rates of Penta3 (measured as DPT3) coverage (53%) and also found inequity in urban versus rural almost 80% of children in urban areas received three doses of the DPT vaccine, while only half of those living in rural areas did, with regional differences; the lowest coverage reported in Afar (20%) and the highest in Addis Ababa (96%).[101]

ADAPTATION DURING IMPLEMENTATION

The FMOH addressed the drop-out rate of this vaccine through a tracking mechanism utilized at the community level. Under this system, HEWs identified, registered, and tracked unvaccinated children in their communities. However, a key informant identified ongoing "not acceptable" dropout rates per FMOH standards between doses as a continuing challenge requiring improvement.

SUSTAINMENT

The Government of Ethiopia began co-financing pentavalent activities in 2012.[101] The 2016-2020 EPI cMYP set new objectives to reach 90% national coverage and 80% district-level coverage of all vaccines, including pentavalent, by 2020. Strategies established to achieve these targets included reducing the national dropout rate to 2% (and to less than 50% in all districts) and ensuring availability of immunization service in all kebeles (the country's smallest administrative unit) by 2020.[78] The FMOH's National Strategy for Newborn and Child Survival (2015-2019) identified pentavalent vaccination as a key intervention for improving child survival. This plan set a national goal of increase pentavalent coverage to 96% by 2020.[102]

In 2015, the Government of Ethiopia applied for and was given additional funding by GAVI to support implementation of the pentavalent vaccine through 2020. This agreement provided a budget of nearly $12.6 million for pentavalent activities in addition to the $213.5 million the country received from 2007 to 2015. The government co-funded approximately $1.5 million in 2016 for these activities, with a commitment of $0.20 per dose. In 2014, the government estimated it would co-finance approximately 13% of the total costs for the pentavalent vaccine from 2017 to 2020.[79]

Table 21: Hib Vaccine Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to understand disease burden	(+) Pentavalent vaccine introduced to address burden of both Hib and Hepatitis B disease
Acceptability	Free immunization services	No evidence of refusal found
Feasibility	Application for GAVI support of pentavalent introduction Expansion of cold chain capacity prior to vaccine roll-out Integrated into routine immunization schedule Decision to delay introduction to use pentavalent vaccine due to low global availability and preference over tetravalent vaccine Cascaded training for health workers GAVI funding	(-) Delayed introduction following global shortage (+) Introduction in all regions achieving coverage shown in *Effectiveness and Coverage (Reach)*
Effectiveness and Coverage (Reach)	Integrated into EPI routine vaccination schedule and EPI monitoring Use of the pentavalent vaccine Free immunization	(+/-) High Penta 3 coverage in 2016 per administrative estimates (96%), though lower coverage estimated by WHO/UNICEF (73%) and DHS (53%) with significant gaps
Fidelity	Regular supportive supervision as part of "Reaching Every District" approach	(-) Challenges in dropout between Penta 1 and Penta 3
Cost	GAVI funding	Not found
Sustainability	Integration into existing EPI infant vaccine schedule Extended GAVI funding Government co-financing	No evidence of stockouts seen and ongoing commitment to continued vaccination
Equity	Free immunization services Use of HEWs (for geographic coverage)	(-) Variability of coverage at regional level – from 20% in Afar to 96% in Addis Ababa per 2016 DHS (-) Lower coverage in rural and lower wealth populations in 2016

4.1.5 Other Malaria Interventions

4.1.5.1 Insecticide-Treated Nets

Table 22: ITN Key Implementation Strategies

Implementation Strategies

• National commitment
• Leveraging donor and partner support
• Free distribution
  ○ Data use
  ○ Monitor coverage and quality of distribution
  ○ Accountability
  ○ Community registration
  ○ Prioritization
• Target setting
• Training (cascaded)
• Community engagement, empowerment, and mobilization
• Social marketing
• Leveraging on existing systems including HEWs
• Multiple strategies for distribution
  ○ Enhanced outreach strategy
  ○ Routine distribution
  ○ Door-to-door distribution
  ○ Campaigns
  ○ Community empowerment and mobilization component

EXPLORATION

Approximately 75% of Ethiopia's land is malaria endemic, covering all regions except Addis Ababa, with the majority of the country's population living in these areas. Transmission occurs primarily in areas in Ethiopia with altitude under 2,000 meters, though endemic areas also exist above 2,000 meters.[103] While the country experiences cycles of malaria epidemics every five to eight years, low levels of malaria transmission continue during non-epidemic years, typically between September and December, following the main rainy season.[104] Though malaria transmission occurs in most areas of Ethiopia, its contribution to U5 deaths in Ethiopia as estimated by IHME is quite small – in 2000, malaria was estimated to cause only 2.4% of all U5 deaths in the country.[105]

Distribution of ITNs through the Ethiopian health care delivery system began in the returnee and resettlement sites in western area of the Tigray region abutting Eritrea in 1997. ITNs were also distributed in the Oromia, Amhara, and SNNPR regions in 1997-1998 with the support of WHO and the Italian Development Cooperation.

PREPARATION

In 2000, the Government of Ethiopia signed the Abuja Declaration on malaria. In signing this document, the government made a commitment to implement strategies for Roll Back Malaria, including ensuring that by 2005 at least 60% of those at risk of malaria would benefit from protective measures such as use of insecticide-treated mosquito nets.[106]

Recognizing the existing gaps and in preparation for large-scale distribution of ITNs, the government submitted a proposal to the Global Fund Round 2 for support from the period of January 2003 to December 2007. This funding allowed the FMOH to procure 6 million long-lasting insecticidal nets (LLINs) for free distribution.[107] Additional partners such as UNICEF, World Bank, and the Carter Center also provided substantial support for procurement of ITNs.[108] In particular, the Carter Center aided in acquisition of 20 million ITNs for national distribution. This distribution (see below) did not start until 2005.

The FMOH and RHBs partnered with UNICEF to develop a national ITN database, which records the number of ITNs distributed in each kebele of the country. Under this system, all households receiving ITNs are recorded in a community ITN register book, which are then compiled by each district health office and sent to the RHB and federal levels.[108]

Implementation

Prior to large-scale, national distribution of ITNs, small-scale distribution campaigns occurred between 2000 and 2003 with the donation of 1.42 million ITNs by UNICEF.[109]

Although use of ITNs had been an area of emphasis in the FMOH's first National Five-Year Strategic Plan for Malaria (2001-2005), the 2005 Ethiopian DHS found that only about 6% of households owned either treated or untreated nets and even fewer owned a treated net (3.3%), reflecting the delay in distribution until 2005.[29,110]

As part of the new initiative to increase ITN coverage, the FMOH initiated free distribution of LLINs in 2005, with a goal of distributing two LLINs per household in malaria endemic areas below 2000 meters altitude. Three main delivery strategies were utilized for distribution of free LLINs: 1) enhanced outreach strategy (EOS), 2) routine distribution through health facilities, and 3) door-to-door distribution by HEWs. Though the program initially relied heavily on routine distribution, it later utilized distribution campaigns implemented by HEWs. During these campaigns, which are intended to occur every three years due to the lifespan of the nets, HEWs are responsible for both community education and actual distribution. HEWs mobilize their communities to register to receive ITNs. Each household is entered into a community register, which is later used for auditing. Recipients of ITNs then sign the register and are given ITNs by HEWs, who remove packaging prior to distribution to ensure the nets are not resold. To ensure effective usage, HEWs also provide education about transmission of malaria and preventive measures, including correct use of ITNs, through house-to-house visits, larger community meetings, and at health posts.

As was the case for large-scale training initiatives for other EBIs, training for the ITN distribution program utilized a "top-down", cascading approach. The FMOH provided an orientation TOT at the national level with support from the Global Fund. Training for the distribution program was then cascaded to the regional level, then down to the lowest health post level by RHBs, who were provided budgets by the FMOH to conduct training activities.

The FMOH monitored quality of distribution through several methods. It collected and reviewed data from community registration books to evaluate quality of registration at the time of distribution. Meetings with all RHBs and stakeholders were also used to evaluate the overall process of each distribution campaign and ensure ITNs were properly used. In addition, post-distribution assessments were performed for each campaign.

The country's second National Five-Year Strategic Plan for Malaria Prevention and Control in Ethiopia 2006-2010 was released in April 2006. This plan identified ITNs as a vector control activity targeted for areas with transmission periods of three or more months. It set a new goal of achieving distribution of on average two ITNs per household in 90% of target areas by 2007.[110]

LLIN distribution campaigns were also implemented in 2010 and 2015. This strategy resulted in distribution of 23.8 million LLINs by the end of 2007. Between 2005 and 2011, continuation of this distribution plan led to provision of a 43.1 million LLINs to people living below 2,000 meters in all regions. While increased, ownership of LLINs in in malarious areas of the country remained fairly low – 66% in 2007 and 55% in 2011.

ADAPTATION DURING IMPLEMENTATION

The National Strategic Plan for Malaria was revised in 2010. In efforts to build upon the gains made in the 2006-2010 period, this new plan featured a community empowerment and mobilization component for malaria prevention and control, especially in areas of unstable malaria transmission.[111] This component, which utilized the HEP, aimed for 100% of people living in malarious areas recognizing the importance of using an LLIN and 100% of health posts in these areas providing a full health extension package, which includes outreach services, social communication and mobilization, and model family households.[111] The strategy for distribution of LLINs began to utilize a continuous rolling campaign approach with households receiving new LLINs every three years, the estimated lifespan of the nets. This strategy ensured continued coverage of households in malaria endemic kebeles beyond initial distribution.[112]

In 2011, the FMOH's LLIN distribution strategy was expanded to include free provision of LLINs in all malaria endemic areas.[113] Despite these efforts, gaps remained. In 2015, the Ethiopia National Malaria Indicator Survey (MIS) reported that only 64% of households in malarious areas less than 2,000 meters above sea level owned at least one LLIN. In addition, only 32% of households had at least one LLIN for every two people that stayed in the house the night before the survey. The survey also found that only 64% of existing LLINs were actually used the night before the survey, ranging from 56% in Tigray, Amhara, and SNNPR to a high of 87% in Afar. As a result, only 45% of children under the age of 5 living in malarious areas slept under a LLIN the night before the survey. Though coverage of LLINs remained lower than the

target in spite of widespread distribution campaigns, this survey reported improved parasitemia compared to the previous 2011 MIS from 4.5% in 2011 to 1.2% (1.4% in children U5).[114] Discussing the low coverage reported by the survey, a key informant noted:

> *"Several reason[s] can be mentioned here, probably after distribution there are some families that [have] been created, get married and some households may not get the distribution and probably the distribution was based on the population census of 2007 and there might be changes in demography. People may migrate out of their previous area and you know the denominator issue is always a problem. While you are allocating resources you use the available denominator [and] that resource may not be 100%. This thing may be part of the reasoning and at times people may not go and take this ITNs, some of the reason may be these but we need to dig out more."*

Another key informant explained that 2015 was a replacement year for ITNs and the survey was conducted prior to ensuring ITNs were actually delivered to the households. At the time of the survey, ITNs had been procured but not yet distributed to all households. Therefore, coverage at the end of this process was likely higher than reported in the survey.

SUSTAINMENT

Overall, Ethiopia received approximately $514.4 billion from the Global Fund to support malaria activities, including LLIN distribution, over the period of 2003 to 2015.[114] Ethiopia received additional support from Global Fund Rounds 5 and 8. As it was not eligible to receive funds from Rounds 10 and 11 for procurement of additional LLINs, threatening sustainment of the program's progress, the government submitted a Transitional Funding Mechanism to Global Fund to cover distribution from 2013 to 2014. The President's Malaria Initiative (PMI) also supported the FMOH's mass distribution efforts. It procured over 23 million LLINs between 2008 and 2015, with plans to procure an additional 14 million nets using fiscal year (FY) 2015 to 2017 funds.[112]

Table 23: ITN Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for prioritization	
Acceptability	Community engagement, empowerment, promotion and social mobilization of ITN use Distribution of free nets HEWs	(-) Per National MIS (2007, 2015) only 2/3 of nets were used the night before the survey
Feasibility	Leverage of donor support – Global Fund National commitment Initial prioritization of endemic areas below 2,000 meters prior to distribution in all endemic areas	(+) Widespread distribution was feasible (+) Delivery achieved through using multiple approaches including outreach to ensure coverage

	Leveraging of existing HEP for distribution	
Coverage and Effectiveness (Reach)	Distribution of free LLINs through several strategies: 1. EOS 2. Routine distribution through health facilities 3. Door-to-door distribution by HEWs 4. Campaigns 5. Community mobilization Distribution every 3 years to ensure continued effectiveness/coverage based on LLIN lifespan Expansion of free nets to all malarious areas Data use for monitoring coverage and community registration	(+/-) Per MIS: Household ownership of ITNs reached 66% in areas <2000m in 2007 and remained steady (64%) through 2015 (+/-) MIS: In 2015, almost half (49%) of the population had access to an LLIN. LLIN access varied by region – from 24% in Harari to 59% in Tigray. (+) MIS: decline in all-age parasitemia (by RDT) from 4.5% in 2011 to 1.2% in 2015, U5 parasitemia of 1.4% in 2015 (-) Access to an LLIN in the household in 2015 varied by region, from 24% in Harari to 59% in Tigray
Fidelity	Training of health workers (cascaded) Monitoring and evaluation Data use for accountability	(+) Targeting for higher risk areas
Cost		
Sustainability	Continued support by the Global Fund and PMI for procurement of nets	(-) Reliance on external funding and procurement of nets limits sustainability
Equity	Mass campaigns and distribution Free distribution	(-) Access to an LLIN in 2015 varied moderately by wealth quintile: Lowest – 35 Highest – 50%

4.1.5.2 Indoor Residual Spraying

Table 24: IRS Key Implementation Strategies

Implementation Strategies

• Adoption of global data on effectiveness
• Data use
  ○ Targeting of intervention
  ○ Adaptation based on resistance data
• Leveraging existing systems and structures
• Community engagement
• Leveraging donor and partner support
• Training (cascaded)

EXPLORATION

The WHO has recommended indoor residual spraying (IRS) as a key vector control intervention for control and elimination of malaria since well before 2000. In 2006, it released a position statement recommending scale-up of IRS as a strategy for achieving malaria-related MDGs by 2015.[115]

IMPLEMENTATION AND ADAPTATION DURING IMPLEMENTATION PRE-2000

IRS was adopted in Ethiopia in 1959 as part of WHO's Global Malaria Eradication Program. Though the program was phased out globally in 1969, the Government of Ethiopia continued to carry out spraying campaigns solely with its own funding. Blanket spraying with Dichlorodiphenyltrichloroethane (DDT) was implemented in almost all areas of the country affected with malaria until the late 1970s. The country's eradication program was later adapted into a control program utilizing selective application IRS in the early 1980s. However, shortage of both funding and supplies during to the 1990s resulted in inadequate targeted spraying.[116]

In the early 1990s, IRS operations were decentralized and managed entirely at the regional and district rather than national levels. IRS is implemented in malaria-endemic kebeles, which are selected within each woreda based on factors including history of malaria cases, altitude, and presence of mosquito breeding sites.

IMPLEMENTATION AND ADAPTATION DURING IMPLEMENTATION POST-2000

Following the funding shortage in the 1990s, the Ethiopian government funded IRS activities through 2005. It also received partial support for IRS activities from the Global Fund and PMI in 2003 and 2007, respectively.[117]

DDT was used as the primary insecticide for IRS in Ethiopia for 40 years. However, deltamethrin was introduced as the insecticide of choice in the mid-2000s due to growing levels of resistance to DDT in most areas of the country. However, DDT continued to be used in areas were the local vector was susceptible.[113]

The FMOH further adapted its IRS strategy to implement activities through the country's HEP. Integration of IRS into this program was intended to minimize logistical difficulties that previously limited IRS coverage nationally. The PMI Africa Indoor Residual Spraying (AIRS) project piloted this community-based IRS model in the Kersa district of Oromia in 2012. Under the community-based approach, IRS activities continued to be planned and supervised by district health office teams but under this strategy were carried out by squads of four to five sprayers, led by HEWS.[118]

Based on the successful pilot of the community-based IRS model, this strategy was introduced in four regions of the country (Amhara, Oromia, SNNP, and Tigray) which, according to a key informant, had strong enough community structure for community-based spraying to be feasible. A TOT was given to people from each of these regions and training was cascaded by respective RHBs using training materials prepared by the FMOH.

The National Five-Year Strategic Plan for Malaria Control in Ethiopia (2001-2005) established a goal of reaching 60% IRS coverage in epidemic-prone areas by 2005. However, only 30% of these areas were estimated to have been sprayed by 2007 due to lack of funds available for spraying. Coverage reached 47% in 2011 after the country's Global Fund Round 8 proposal included a significant budget for these activities, aiming to cover at least 90% of households in epidemic-prone areas by 2013.[119]

The 2015 Ethiopia National MIS assessed coverage of preventive interventions targeting malaria, including IRS. This included all households, including those not targeted for IRS, and likely represents an underestimate at 29% of households in malaria-endemic areas were sprayed in the 12 months preceding the survey. The survey found that coverage of IRS in malarious areas varied greatly by region, from only 2.3% in Afar to 44% in Benishangul-Gumuz. However, coverage in areas targeted for IRS was higher, as IRS was not intended to be implemented in all malarious areas of the country covered in the survey[114] with reported 92% of structures in targeted areas were sprayed in 2015-2016.[54]

SUSTAINMENT

Ethiopia continued to receive funding from PMI and the Global Fund to support malaria prevention and control activities, including IRS. PMI provided budgets of $40 million, $38 million, and $32 for million the years 2016-2018, respectively.[112,120,121] The Global Fund provided $116 million in malaria grants to Ethiopia between July 2015 and December 2017.[122]

Table 25: IRS Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to target spraying in priority areas based on transmission	(+) IRS implementation targeted specific areas of malarious kebeles
Acceptability	Use of community-based spraying	No refusal data found
Feasibility	Leveraging HEP Utilization of donor funds Targeting areas for community-based spraying based on HEP strength to support implementation Training (cascaded)	(+) IRS was able to be implemented (although see reach) (+) HEWs able to support expansion of community-based spraying to targeted communities
Effectiveness and Coverage (Reach	Data use to identify target areas Selection of insecticide based on known resistance Use of	(-) 2001-2005 target for IRS (60%) not met (30%) due to lack of funds (+) Coverage in targeted regions was higher – 92% of targeted structures were sprayed in 2015/16 (-) significant regional variability

Fidelity		(+) In 2013, compliance with standard spraying procedures was 81% in districts using community-based IRS and 92% in those using district-based IRS[122] (+) 2013 spray quality assessment in Oromia found mortality of mosquitoes exposed to sprayed walls to be 99.5% in district-based IRS districts and 99.9% in community-based IRS districts[123]
Cost	Not found	Not found
Sustainability	Ongoing donor support	Not found
Equity	Not found	Not found

4.1.5.3 Intermittent Preventive Treatment of Malaria During Pregnancy

EXPLORATION

Intermittent preventive treatment of malaria with sulfadoxine-pyrimethamine during pregnancy (IPTp) has been increasingly utilized in sub-Saharan Africa and is recommended in all areas of the continent with moderate to high malaria transmission by WHO.[124] However, use of IPTp in areas of unstable or seasonable transmission is not currently recommended. As Ethiopia has generally low endemicity of malaria, IPTp is not a national strategy. The FMOH decided not to adopt IPTp for three main reasons: 1) Ethiopia's burden of disease is too low to merit universal IPTp; 2) The country's very low ANC utilization rates suggest that even if IPTp was adopted nationally, the number of women reached would be very low; and 3) Concern that increasing resistance to sulfadoxine-pyrimethamine would affect efficacy for its use for IPTp.[104]

PREPARATION

The FMOH has no plans to implement IPTp in Ethiopia.

4.2 Other Vaccine-Preventable Diseases

Table 26: Other Vaccine-Preventable Diseases Key Implementation Strategies

Implementation Strategies

• Integration into existing programs
  ○ HEWs
  ○ EPI
• Use of outreach activities
• Community engagement and education
• Stakeholder engagement
• Data use for decision-making and prioritization

- Leveraging of donor and partner support
- Training
- System strengthening
- Vaccination campaigns
- Free immunization services

4.2.1 Measles Vaccination

Table 27: Measles Vaccination Unique Implementation Strategies

Additional Implementation Strategies

• National commitment (elimination goals)
• Catch-up strategy
• Use of outreach activities including community education
• Data use
  ○ Expanded surveillance and case finding
  ○ Supplemental campaigns based on epidemiology
  ○ Prioritization

IMPLEMENTATION AND ADAPTATION DURING IMPLEMENTATION PRE-2002

National implementation of the measles vaccine began in 1980 with the launch of the EPI. As one of six vaccines initially included in the EPI, the measles-containing vaccine (MCV1) was part of the routine immunization schedule to be given as a single dose at or shortly after 9 months. The EPI's initial goal was to increase national immunization coverage by 10% each year and achieve universal child immunization by 1990. However, coverage only increased 2.9% on average per year. Civil war in northern Ethiopia and the government change impacted immunization activities in the early 1990s, with measles vaccination coverage falling to 19% in 1991, then to 12% in 1992. Coverage increased between 1993 and 1997, with measles coverage reaching over 50% for 1996-7.[125]

After a short-lived decline in coverage in 1998 attributed to several factors, including the Eritrean-Ethiopian War, the FMOH conducted a series of phased SIAs from 1999 to 2001. These activities targeted children under 5 in selected zones located in all regions and vaccinated a total of 12 million children. SIAs over the period of 1999 to 2001 had fairly high overall coverage, ranging from 75% to 79%. However, the ranges in coverage was wide as 27% to 100% (2001) show challenges in zonal-level coverage achieved by these SIAs.[126] Overall, the 2000 DHS found immunization coverage to be 27% nationally. Regional coverage varied widely from 11% in Afar (typically the lowest for vaccine coverage) to 88% in Addis Ababa.[126]

IMPLEMENTATION AND ADAPTATION DURING IMPLEMENTATION POST-2002

Case-based surveillance conducted in a small number of zones in Ethiopia indicated that the burden of measles cases had shifted from children under 5 to those older than 5 years of age reflecting the focus on catch up for U5 only. Due to this shift, the FMOH broadened the scope of its SIAs to include children under 15.

Catch-up measles SIAs in Ethiopia resumed in 2002 due to the stagnant coverage rates, at first targeting the highest-risk areas in the country. These activities, which were supported by WHO and UNICEF, were also conducted in a phased approach covering different geographic areas due to limited resources and logistical constraints. Using surveillance data, this strategy prioritized target areas based on measles risk levels and feasibility of effective implementation. The first catch-up phase of this new round of SIAs was conducted in 2002 and targeted 12.3 million children between 6 months and 14 years of age in 18 districts with outbreaks. Two supplemental immunization activities phases were conducted the following year, targeting children of the same age range in 35 of the country's 800 woredas. Additional phases between 2004 and 2005 targeted the remaining areas of the country, targeting the widened age range of children from 6 months to 15 years.

Large-scale, case-based surveillance coordinated by the Ethiopian Public Health Institute also began in 2003. This surveillance has been supplemented by laboratory surveillance since 2004.[78]

In 2005, the FMOH began implementing follow-up plans in all regions at two-year intervals to reduce accumulation of a population of susceptible children entering eligible age for immunization that did not benefit from routine vaccination (catch-up). The country's first two follow-up campaigns were conducted in a phased manner to alleviate the activities' burden on HRs. The first follow-up campaign was conducted from 2005 to 2006. This campaign targeted 12,813,189 children from 6 to 59 months of age and achieved 89% administrative coverage of targeted populations. A second phase of follow-up activities were implemented during 2007-2009 and had 93% administrative coverage for a target population of nearly 13 million children aged 6-59 months. The country continued to conduct follow-up campaigns every two to three years with support from GAVI.[99]

In addition to these supplemental immunization activities, there was work to improve routine vaccination. The measles vaccine continued to be administered through routine vaccine services at health facilities (including health posts) and outreach sites following national guidelines. Since 2004, some areas of the country also conducted "Child Health Days," or Enhanced Outreach Services, every six months. These outreach activities provided immunization services integrated with other interventions such as vitamin A supplementation and deworming for children under 5 years.

In 2011, the vaccination program encountered a new challenge. A severe drought in the horn of Africa resulted in an influx of mostly unvaccinated refugees from Somalia in Ethiopia, particularly into the Somali region. The increased measles incidence and low coverage at the zonal level resulted in additional emergency supplemental immunization activities. The supplemental measles immunization activity, which was integrated with polio campaigns, was implemented in six regions, 32 zones, and 146 woredas

selected based on drought situation and history of recent measles outbreaks. These activities resulted in vaccination of 7,034,264 children between 6 months and 15 years of age.[78]

As is the case for many vaccines implemented in Ethiopia, there are varying estimates of coverage for measles immunization (Figure 24). Despite all the efforts, WHO and UNICEF estimated that MCV1 coverage only modestly increased from 44% in 2006 to 65% in 2015. The 2016 DHS found greater gaps in coverage with only 54% of children aged 12-23 months and 55% of those aged 24-36 months having received the measles vaccine. Large geographic differences in coverage were also observed. Regional coverage ranged from 30% in Afar to 93% in Addis Ababa. While 76% of children in urban areas received the vaccine, only 52% of those in rural areas did. Though equity graphs show improvement in coverage across all wealth quintiles from 2000 to 2016, large gaps in equity between these groups persist. The 2016 DHS found that coverage of the measles vaccine was only 43% in the lowest wealth quintile and reached 74% in the highest quintile.[2] However, there were differences in the FMOH's administrative estimates that indicated coverage of 92% in 2015, possibly as the result of different denominator use and data quality issues that persisted across all levels of the health system, according to a key informant.[83]

Measles surveillance indicated that despite increases in coverage, the incidence rate of confirmed measles cases in Ethiopia actually increased from 0.6/100,000 in 2005 to 11.1/100,000 in 2014. However, it is likely that this change also represented strengthening of the measles surveillance system and its improved ability to detect and report cases as well as persisting gaps in coverage. In addition, the shifting proportion of measles cases in children under 5 from 56% in 2008 to 30% in 2014 indicate the effectiveness of routine vaccine and the appropriateness of the catch-up campaigns.[125]

Despite the efforts described above, limited vaccine acceptance due to community perceptions may continue to affect coverage. Per a key informant, *"there is a belief that measles is not a severe disease; it can be self-limiting [and] get out by its own ('twetalch' in Amharic)."* Estimates by WHO/UNICEF may also remain low compared to other vaccines as measles is the last vaccine given in the routine immunization schedule, with a long-time interval between administration of the pentavalent (14 weeks) and measles (9 months) vaccines, requiring a separate visit.

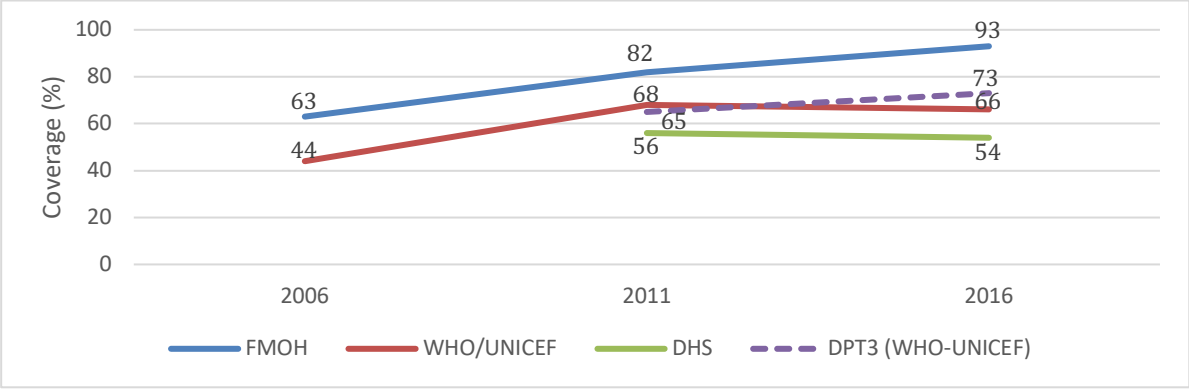


Figure 22: Measles Immunization Estimated Coverage, Compared with DPT3 (2006-2016)

SUSTAINMENT

Ethiopia continued to conduct supplemental immunization activities supported by GAVI every two to three years to improve and sustain coverage as well as efforts to continue routine vaccination.[126] Per Ethiopia's 2015 National Immunization Programme Planning document, the country aims to achieve elimination of measles by 2020. The FMOH's approach to achieving this goal includes conducting a wide age-range campaign, improving routine immunization, utilization of supplemental immunization activities for outbreak response, and introduction of second dose MCV.[78]

Ethiopia also introduced the second dose of the measles vaccine in February 2019 with GAVI support to improve immunity in the country and reduce morbidity and mortality associated with measles. This second dose was integrated into the country's routine immunization schedule, with administration planned for all children in the second year of life.[127]

Table 28: Measles Vaccine Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for prioritization of target areas and age group	(+) Broadened scope of immunization activities to reflect shifting disease burden
Acceptability	Inclusion in "Child Health Days" in some distr icts	(-) Remaining belief in communities that measles is not severe per key informant (-) Required separate visit at 9 months of age
Feasibility	Integrated into routine immunization schedule GAVI funding and other partner support Supplemental vaccine campaigns Case-based measles surveillance	(+) Measles vaccines given both as routine and through catch-up as well as targeted to meet needs of refugees (-) Large numbers vaccinated
Effectiveness and Coverage (Reach)	Integrated into EPI routine vaccination schedule and EPI monitoring Supplemental Immunization Activities for increased coverage Free immunization Adaptation to include second dose (after study period) Post study period: Introduction of 2nd dose in 2019	(+/-) 2015 coverage: 65% per WHO/UNICEF estimates, 92% per FMOH (-) See equity (+/-) Increased in number of measles cases over study period, believed to be due partly to increased sensitivity of surveillance system (+) Decrease in U5 proportion of measles cases from 56% in 2008 to 30% in 2014[125] (-) Acceptability issues limit coverage
Fidelity	Not found	Not found
Cost	Not found	Not found

Sustainability	Continued GAVI funding Integration into national program, ongoing surveillance to ensure focus on need Goal for elimination (national leadership)	(+) Measles vaccination is an integral part of the national U5M reduction strategy and in the HMIS and EPI schedule
Equity	Free services and use of supplemental immunization activities Leveraging HEWs	(-) Per 2016 DHS, gaps in coverage between wealth quintiles (43% in lowest quintile to 74% in highest) (-) Large regional variation in coverage per 2016 DHS – from 30% in Afar to 93% in Addis Ababa

4.2.2 Meningococcal Vaccination

Table 29: Meningococcal Vaccination Unique Implementation Strategies

Implementation Strategies
• Phased approach • Focus on equity • Monitoring and evaluation

EXPLORATION

Following major Group A meningococcal meningitis epidemics in 1996 and 1997 that resulted in approximately 250,000 cases and 25,000 deaths, 26 African ministries of health (including the Ethiopian FMOH) declared epidemic meningitis a public emergency. The WHO created the Epidemic Meningitis Vaccines for Africa project, which formalized work on an African meningitis vaccine. Meningococcal Group A Conjugate Vaccine (MenAfriVac) was officially introduced globally in September 2010 though mass vaccination campaigns targeting those between the ages of 1 and 29 years in three highly endemic or epidemic countries (Burkina Faso, Mali, and Niger).[128]

The WHO conducted a meningitis risk assessment utilizing the district prioritization tool in Ethiopia in January 2012. This study determined meningitis risk by region and identified five regions considered to be at high risk for meningitis outbreaks. The remaining six regions of the country were considered to be at moderate to low risk.[129]

PREPARATION

Due to its location on Africa's meningitis belt and the resulting burden of meningitis epidemics, the Government of Ethiopia submitted an application to GAVI for support of introduction of the meningococcal vaccine in August 2012. Per this application, the FMOH planned to introduce the

meningococcal vaccine via a phased approach beginning October 2013. The FMOH decided to use this phased approach for introduction based on WHO risk assessment output and availability of the vaccine. The approach also was designed to respond to the increased risk of meningitis in the GAVI for the campaign, which was estimated to cost $78,390,434 ($0.65 per target).

As explained by key informant from the FMOH,

> *"The preparation and the process is the same but what is special for meningitis is it was conducted in [a] phase[d] manner, so we had risk mapping categories; we just conducted in three phases, the red phase gets priority then the yellow gets second priority and the green gets third."*

The FMOH utilized the 2009 Vaccine Management Assessment and a rapid cold chain assessment conducted in 2011 to identify gaps and ensure sufficient cold chain space was available for introduction of the vaccine. As a result, the FMOH identified and addressed cold chain gaps prior to its application to GAVI.[77]

IMPLEMENTATION

As planned, in 2013, the FMOH introduced the meningococcal vaccine in a phased approach utilizing mass campaigns to vaccinate individuals between 1 and 29 years of age. The vaccine was implemented in three phases, which as described below achieved impressive coverage, particularly in comparison with other vaccines introduced in the country. Through this approach, the areas already identified to be at high risk for meningitis outbreaks were prioritized for vaccine introduction, with medium and low-risk areas receiving the vaccine in later phases. Activities for implementation were supported by local partners, who provided necessary vehicles and HRs.

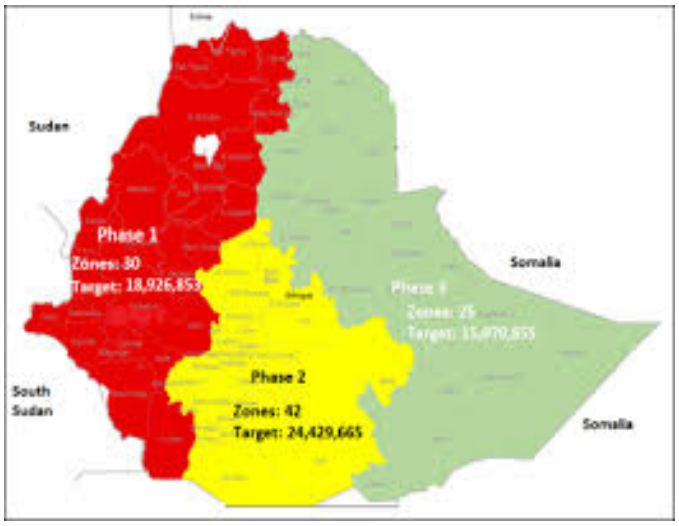


Figure 23: Meningococcal A Vaccine Campaign Targeted Areas by Phase, Ethiopia (2013-2015)

In each phase, social mobilization and community engagement activities were utilized for introduction. Communications plans, advocacy materials, and IEC materials were translated into local languages for each phase. The FMOH used the HEWs and HDA of the HEP and social mobilization networks to engage and inform communities about the vaccine. Promotional messages were also disseminated via national and regional radio and television channels.

Phase 1 (Figure 25 covered 30 high-risk zones in the Tigray, Amhara, Gambella, Benishangul-Gumuz, SNNPR, and Oromia regions of the country. Nearly 19 million people between ages 1 and 29 years

received a single dose of the meningococcal vaccine, achieving 92.4% coverage according to a post-campaign survey.

Phase 2 (Figure 25) began a year later in October 2014. This phase focused on the central and southern areas of the country identified as moderate risk in the 2012 risk assessment, including 45 zones in the Addis Ababa, Oromia, and SNNPR regions. Post-introduction coverage surveys reported an estimated coverage rate of 93.5% in targeted areas.

Phase 3 (Figure 25) was implemented in October and November 2015 in the remaining 28 low-risk zones, (Tigray, Afar, Amhara, Oromia, Somali, Harari, and Dire Dawa). In Phase 3, 15,883,812 individuals between ages 1 and 29 were vaccinated. As in the vaccine's other phases of introduction, the Ethiopian Public Health Institute conducted a post-campaign vaccination coverage survey in these targeted zones from November to December 2015. It found that the overall vaccination coverage for areas of the country targeted by Phase 3 was 93%. Regional coverage varied from 97% in parts of Tigray to 88% in parts of Afar.[130]

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

The FMOH planned to protect birth cohorts in Ethiopia by introducing the meningococcal vaccine into the routine EPI schedule by 2016. However, as of 2019, the vaccine had not been incorporated in the routine schedule and continued instead to be provided in areas with outbreaks. In addition, it organized follow-up campaigns every five years to target children 1 to 4 years of age who were not covered by routine immunization activities.[130]

Table 30: Meningococcal Vaccination Implementation Strategies and Outcomes

Implementation Outcomes	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making • **WHO assessment to determine burden of meningococcal disease prior to introduction**	(+) Prioritization based on risk using assessment data
Acceptability	Community engagement and social mobilization activities	(+) High vaccine acceptance per FMOH
Feasibility	Introduction via phased approach prioritizing high-risk areas Utilization of donor funding Previously strengthened cold chain Introduction in phased approach to reflect vaccine availability and resources	(+) All 3 phases completed as planned as a single dose campaign

Effectiveness and Coverage (Reach)	Use of risk mapping data to prioritize vaccine roll-out in highest risk areas of country Mass vaccination campaigns Use of HEWs	(+) High coverage in target areas per FMOH post-campaign coverage surveys:[130] • Phase 1: 98.4% • Phase 2: 97.6% • Phase 3: 93%
Fidelity	Not found	Not found
Cost	Not found	Total estimated cost of $78,390,434
Sustainability	Integration into routine EPI immunization schedule and follow-up campaigns every five years	Not found
Equity	Translation of advocacy, communication, and education materials into local languages	(+) High coverage across the country, with limited geographic variation (from 88% in parts of Afar to 97% in parts of Tigray)

4.3 HIV

Table 31: HIV Program Key Implementation Strategies

Implementation Strategies
• National policy and planning • Adoption of international guidelines • Integration into existing programs and systems • Leveraging of donor and partner support • Free service delivery • Decentralization of care delivery • Health infrastructure and system strengthening • Stakeholder engagement • HR strengthening including through training

4.3.1 Prevention of Mother-To-Child Transmission of HIV

Table 32: PMTCT Unique Implementation Strategies

Implementation Strategies

• Data use for decision-making
  ○ Data use to determine disease burden
  ○ Data use for adaptation
• HR task shifting
• Leveraging existing systems
• Ensuring access and geographic reach
• Leveraging partner support
• Community engagement and education

EXPLORATION

Mother-to-child transmission (MTCT) is the primary mode of HIV acquisition in children, accounting for about 90% of pediatric cases and demonstrating the importance of reduction of MTCT to reduce the burden of pediatric HIV. In 1997, a study conducted at Jimma Hospital in the Oromia region found that the seroprevalence of HIV among pregnant women attending antenatal care (ANC) was 12.1%.[131] Ethiopia's national HIV/AIDS policy was enacted in 1998. Two years later, the National HIV/AIDS Council declared HIV a national emergency. In 1999, the FMOH estimated that MTCT contributed to up to 25% of all new infections of HIV. There were an estimated 250,000 children infected with HIV in 2000 and according to IHME estimates that the same year, HIV/AIDS caused 5% of all U5 deaths.[132,133]

Discussing prioritization of prevention of mother-to-child transmission (PMTCT) in Ethiopia, a key informant explained:

> *"The prevalence of mortality among pregnant women was considerably high and though it was in a good attention even in terms of sentinel surveillance early on. So, because maternal and child health generally got prioritization, by default it was a major problem in that population group and got attention."*

PREPARATION

In 2001, the FMOH prepared a five-year national strategic framework (2001-2005) for HIV/AIDS. One major intervention area in this framework was expansion of voluntary counseling and testing (VCT) for HIV. That same year, the FMOH released the country's first MTCT guidelines, *National Guidelines on the Prevention of Mother-to-Child Transmission (PMTCT) of HIV in Ethiopia*. Several partners were involved in their development, including WHO, UNICEF, and USAID. These guidelines adopted the four-pronged approach to PMTCT recommended by WHO:[134]

1. Primary prevention of HIV infection
2. Prevention of unintended pregnancies among HIV-infected women
3. Prevention of HIV transmission from infected women to their infants
4. Treatment, care, and support of HIV-infected women, their infants, and their families.

The guidelines promoted VCT and provision of testing at health facilities integrated into ANC as part of its strategy to decrease vertical transmission of HIV. HIV testing became a routine component of standard maternal health care in the public system.

The Government of Ethiopia received $370 million from the Global Fund from 2004 to 2015 to support progress towards HIV-specific objectives, including PMTCT.[101]

IMPLEMENTATION

Following release of Ethiopia's five-year national strategic framework in 2001, the number of HIV counseling and testing (HCT) sites in the country increased from by more than 20% each year, reaching

1230 sites by March 2008. In 2008, about 64% of the all hospitals and health centers in the country offered HCT services. In addition to increasing the number of facilities in the country providing HCT, the FMOH focused on expanding the number of health workers trained in HCT.

Training of health workers for PMTCT has primarily been given as in-service training. Refresher trainings combining both the basic training and updated material have been utilized in order to incorporate adaptations to PTMCT guidelines and address significant turnover of trained staff at health facilities. Since 2004, nearly 34,000 HEWs have been trained and deployed to community health posts to address key health topics, including HIV. HEWs facilitate regular "community conversations" on health topics, including HIV testing and treatment. Additional cadres of HIV/AIDS-focused health staff have also been created. An accelerated health officer training program was also launched in 2005. This program trained and deployed 3,573 health officers to lead HIV services and patient follow-up at health centers. Community counselors were additionally trained to address counseling and testing at health facilities. These efforts have aided Ethiopia in successfully task shifting and increasing its workforce providing HIV services.[135]

Antiretroviral (ARV) prophylaxis for mothers and infants was introduced at all levels of the health system in 2009, including at health posts.[135] In addition, hospitals and health centers were expected to provide antiretroviral therapy (ART) for eligible HIV-positive (HIV+) pregnant women and their families and to follow up on all infants born to HIV+ mothers. Facilities are instructed to provide ART for HIV+ women considering pregnancy, if not already on treatment and ARVs. Prophylaxis with short course ARVs to reduce risk of MTCT was recommended for pregnant women who do not meet criteria for ART.

As improving the number of health facilities providing PMTCT was identified as integral to increasing the number of individuals receiving PMTCT, the FMOH prioritized increasing the number of facilities beginning in 2005. In 2005, 129 health facilities in Ethiopia provided PMTCT. This number increased to 1,352 by 2010.[135]

Focusing on demand side interventions, in 2005 IntraHealth established the Mothers' Support Group (MSG) program, which focuses on reduction of MTCT by providing support for pregnant and postpartum women who are HIV positive. Two of the program's main objectives included increasing access to and utilization of PMTCT services. MSG established health center-based peer support groups consisting of trained "mentor mothers," pregnant women, postpartum women, program graduates, and community members.[136] The program began with establishment of three sites in 2005 and scaled up to 85 sites across six regions and city administrations by 2008. The FMOH took over the MSG program in 2013 following its introduction of Option B+. National scale-up of the program followed, though it was fairly slow to progress.[137,138]

This reach was reflected in the increase in women receiving PMTCT. From mid 2004 to mid 2005, an estimated 1,314 people received PMTCT services in Ethiopia. From mid-2009 to mid 2010, this number increased to 6,990. Coverage of PMTCT remained very low, though it increased from 5% in 2006/07 to 8% in 2009/10.[135]

An assessment of PMTCT services between 2006 and 2010 found that the proportion of women who received ANC care at facilities providing PMTCT increased from 22% in 2006 to 38% in 2010. It found a three-fold increase in the proportion of ANC clients provided with HIV counseling services, with 92% of counseled mothers at these sites accepting HIV testing in 2010. In 2010, 53% of HIV+ pregnant women and 38% of exposed infants received ARV.[139]

However, DHS reports found that overall, coverage of testing was much lower in women who gave birth in the previous two years (compared to the previously mentioned coverage in women attending ANC). According to the 2011 Ethiopian DHS, only 14% of pregnant women were counseled and tested for HIV during ANC. This increased to 23% in the country's subsequent DHS in 2016.[22] Rates of testing varied widely by region, from 6% in Somali to 78% in Addis Ababa. This limited overall coverage may have been affected by ongoing low rates of ANC attendance in Ethiopia – in 2016, 37% of women who gave birth in the previous five years did not receive any ANC.[2]

Following international guidelines, Ethiopia adopted Option B+ in 2013. This treatment strategy initiates lifelong ART for all pregnant women who are HIV-positive, regardless of clinical stage or cluster of differentiation 4 (CD4) cell count.

The 2014 ESPA+ reported that availability of PMTCT services at facilities offering ANC services was high across all facility levels. All referral hospitals offering ANC offered HIV testing and counseling services for pregnant women, and 93% also offered PMTCT through provision of ART to HIV+ pregnant women. Availability of PMTCT services was similarly high at general and primary hospitals. Though availability of testing and counseling was also very high (97%) at health centers offering ANC, availability of ART services for HIV+ women was found to be much lower – only 54%. Sixty-two percent of assessed facilities (excluding health posts) providing ANC also provided PMTCT services. A somewhat lower percent (52%) of facilities had at least one staff member recently trained on PMTCT. This assessment found regional differences in availability of PMTCT services at facilities offering ANC, which according to a key informant may be related to differences in geography and infrastructure as well as regional leadership of PMTCT. Availability of PMTCT services was highest in Tigray, where 83% of facilities providing ANC also offered PMTCT. It was lowest in Gambella, with only 35% of ANC facilities in the region offering PMTCT.[30]

The Joint United Nations Programme on HIV and AIDS (UNAIDS) estimated that coverage of pregnant HIV+ women who received ARV for PMTCT reached 70% in 2014. In 2015, an estimated 4,000 new cases of pediatric HIV were averted due to PMTCT. More broadly, the estimated number of new infections of HIV in children under 14 decreased from 15,000 in 2000 to 3,300 in 2015. However, these infections may not be entirely caused to vertical transmission due to the broad age range included in this estimate.[140] The WHO estimated that the final MTCT rate (including the breastfeeding period) in Ethiopia was 16% in 2016.[141]

ADAPTATION DURING IMPLEMENTATION

Updated guidelines released in 2007 in alignment with WHO guidelines established an "opt-out" approach to testing, in which all women receiving ANC, labor, delivery, and post-partum care are

informed of the benefits of HIV testing and told that it is included in their routine laboratory check-up unless they decline testing. This approach to testing was intended to increase acceptability of and decrease stigma around testing to increase the opportunity to prevent MTCT.[142]

The FMOH adopted Option B+ in 2013, aiming to eliminate MTCT by 2015.

SUSTAINMENT

The FMOH developed a MTCT Elimination Plan in 2013 to guide national PMTCT implementation and coordination. This plan set a goal of providing Option B+ to 95% of HIV+ pregnant women by 2015. One key strategy of the plan was to integrate ART services into Maternal, Newborn, and Child Health (MNCH) services through introduction of a simplified Option B+ regimen.[143]

In 2014, the FMOH released its HIV/AIDS Strategic Plan for 2015-2020. This plan identified several existing gaps in the PMTCT program, including inadequate integration of Option B+ into the MNCH platform, weak monitoring and evaluation system for PMTCT, poor access to and utilization of facilities for early infant diagnosis, and low skilled birth attendance coverage. It planned to address these gaps through several activities, including maximizing utilization of HEWs and the Women's Development Army to create demand and use of MNCH services, rolling out Option B+ to all PMTCT sites, and improving the PMTCT monitoring and evaluation system.[144]

Coverage of counseling and testing for PMTCT among pregnant women improved over the study period. In 2015-2016, 95% of eligible pregnant women received counseling and testing for HIV. Regional differences remained a challenge, though, with coverage ranging from 43% in Somali to 100% in Oromia, Harari, Addis Ababa, and Dire Dawa.

Despite the coverage of HIV+ pregnant women who receive ARV for PMTCT reaching improved coverage in 2014 as noted above, this progress was not sustained and coverage dropped to 62% in 2015-2016.[54] Utilization of PMTCT might be impacted by several factors, including low uptake by pregnant women. Low overall utilization of ANC services in Ethiopia most likely contributed to low coverage of PMTCT. Stigma and discrimination surrounding HIV may have also affected uptake of PMTCT services. The FMOH addressed these barriers by increasing awareness about MTCT through education and behavior change communication activities.

The government received funding from several donors, including UN agencies, President's Emergency Plan For AIDS Relief (PEPFAR), and the Global Fund, to support improvement and expansion of PMTCT. For the period of 2015-2017, it received about $42.5 million from PEPFAR, $16.6 million from Global Fund, and $1.1 million from UN agencies.[101]

Table 33: PMTCT Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to determine disease burden	(+) PMTCT introduction reflected disease burden
Acceptability	Community engagement and education Integration into systems Data use for adaptation	(+) Increased uptake of ART and adherence reported by 2009 MSG program evaluation suggested high acceptability (+) High acceptance of provider-initiated testing – 92% of counseled mothers receiving ANC at facilities providing PMTCT services accepted testing in 2010
Feasibility	Leveraging partner support Leveraging donor support Leveraging existing systems	(+/-) PMTCT implemented although challenges with reach
Effectiveness and Coverage (Reach)	FMOH prioritization of PMTCT facility infrastructure improvement - expansion of public facilities providing PMTCT services Integration Large geographic coverage of service expansion HR strengthening- recruitment Decentralization of care delivery HR task shifting Rapid scale-up	(-) 2016 DHS reported 34% of pregnant women were tested for HIV during ANC or labor and received results (+) 70% ARV coverage for PMTCT in 2014 (+) New pediatric cases averted due to PMTCT (+) WHO estimated that the final MTCT rate (including the breastfeeding period) in Ethiopia was 16% in 2016[141]
Fidelity	Guideline development Training	(+/-) 52% of facilities assessed in 2014 ESPA+ reported having at least one staff member recently trained on PMTCT (-): The HIV/AIDS Strategic Plan for 2015-2020 identified several existing gaps in the PMTCT program, including inadequate integration of Option B+ into the MNCH platform, weak monitoring and evaluation system for PMTCT, poor access to and utilization of facilities for early infant diagnosis, and low skilled birth attendance coverage
Cost	Not found	Not found
Sustainability	National policy development Integration into systems	(-) ART coverage remained <90% and even saw drop in ART coverage for pregnant women to 62% in 2015-2016[54]

	Leveraging donor funds	(-) Significant reliance on donor funding
Equity		(-) Regional variation in testing for HIV during ANC or labor in 2016 DHS – from 6% in Somali to 78% in Addis Ababa (-) Regional differences in MTCT, from 4.2% in SNNPR to 15.7% in Dire Dawa[145]

4.3.2 Early Infant Diagnosis and Treatment of HIV

Table 34: Infant Diagnosis and Pediatric HIV Treatment: Key Implementation Strategies

Implementation Strategies

• Adapting global guidelines for local context
• HR strengthening
  ○ Training
  ○ Supportive supervision
• Community engagement
• Decentralization of care delivery

EXPLORATION

In 1999, FMOH estimated that MTCT contributed to up to 25% of all new infections of HIV. There were an estimated 250,000 children infected with HIV in 2000.[132]

PREPARATION

Early Infant Diagnosis

Ethiopia's first PMTCT guidelines were introduced in 2001 to support implementation of the national PMTCT program. These guidelines included recommendation of antibody testing of HIV-exposed infants at 18 months of age, reflecting the best available technology at the time.

ICAP at Columbia University (formerly the International Center for AIDS Care and Treatment Programs) initiated a pilot program for early infant diagnosis at 16 health facilities. Areas of training for workers in these facilities included: dry blood spot collection, sample preparation and dispatch for DNA polymerase chain reaction (DNA PCR) testing, pre-and post-test counseling of caregivers, mechanisms for receiving and communicating results, and linking HIV+ infants to treatment.[146]

Following implementation of this pilot project, a workshop attended by the FMOH, implementing partners, and other stakeholders was held to guide development of the national early infant diagnosis

program in 2006, The FMOH worked with partners such as ICAP to develop the National Early Infant Diagnosis Implementation Plan in 2007. In preparation for scale-up of the program, two laboratories (one in Addis Ababa and one in Hawassa) were renovated by the Ethiopian National Laboratories, CDC, Johns Hopkins University Technical Support for the Ethiopian ART Initiative, PEPFAR, and the Clinton HIV/AIDS Initiative.

Revision of national PMTCT guidelines in 2007 incorporated updated global recommendations on testing of infants born to HIV+ mothers including DNA PCR testing at 6 weeks (or as early as possible thereafter) with a confirmatory antibody test performed at >12 months of age if the initial test is negative. The 2007 guidelines also recommended rapid HIV antibody test for children born to HIV+ mothers over 18 months of age whose status was unknown.[134]

The FMOH's Guidelines for Paediatric HIV/AIDS Care and Treatment in Ethiopia were also released in 2007. These guidelines identified early infant diagnosis as a main component of care for HIV-exposed infants in order to ensure timely access to care for HIV-infected infants. Testing recommendations under these guidelines were aligned with the 2007 national PMTCT guidelines (DNA testing). They emphasize the importance of engaging HIV-exposed infants into care by 6 weeks of age with follow-up for results, initiation of cotrimoxazole preventive therapy, and referral infants diagnosed as HIV-infected for staging, care, and treatment.

Pediatric Treatment

The Government of Ethiopia launched fee-based ART in 2003. Prior to 2003, ART coverage was very low and drugs were only offered at a small number of private facilities in the country. The HIV epidemic reached its peak in Ethiopia in the early- to mid-2000s, resulting in a very high demand for ART. The global treatment movement attracted the attention of the Ethiopian government as well as its partners. These circumstances led the government to initiate a national free ART program, including pediatric treatment, in 2005. In preparation for the rollout of this program, the government signed memorandums of understanding with the Global Fund for supply of ART drugs and PEPFAR for technical support, which were signed at the ambassadorial level by the Minister of Health.

The FMOH leveraged expertise and support of both local experts and several international partners, including universities such as Johns Hopkins University and University of Washington, to develop national standard training materials for health providers. These partners collaborated in weekly meetings to customize existing international training materials on ART to fit the Ethiopian context. These partners were later also involved in training of providers and overall implementation of the program, each working in different areas of the country.

IMPLEMENTATION

Early Infant Diagnosis

Scale up of the national early infant diagnosis program began in January 2008. Initial scale-up was planned to expand from two to six referral laboratories, and more than 1,000 health facilities in the

country.[146] At the time of scale-up, dried blood spot samples were transported by laboratory couriers in Addis Ababa and by clinical mentors in other areas.[147] According to a key informant, the pace of initial scale up of the program was limited by availability of PCR machines, which were only available at the central and regional labs and a very limited number of health facilities.

By 2009, early infant diagnosis programs were in place at 58 hospitals and 23 health centers across the country. At that time, 257 health workers had received training on dried blood spot sample collection and early infant diagnosis protocols, a national increase of 300%.[147]

The Ethiopia Network for HIV/AIDS Treatment, Care, and Support (ENHAT-CS) USAID initiative was implemented by Management Sciences for Health in the Amhara and Tigray regions from October 2011 to 2013. This initiative aimed to support the FMOH by strengthening HIV services in health centers in these two regions chosen because of their low availability of follow-up for exposed infants. At the conclusion of the program, the participating 276 health centers were conducting active follow-up of 6,406 HIV-exposed infants.[148] A program assessment of care between October 2011 and September 2013 found high rates of coverage and fidelity: 96% of the 711 HIV-exposed infants included in the study were being actively followed in the health centers, 93% of exposed infants received at least one DNA PCR test, and 71% of these infants were first tested at 6 weeks of age. However, only 33% of all tested infants with that had a negative first PCR test received a second test for confirmation of HIV status.[149]

Nationally, early infant diagnosis coverage rose to 31% in 2015. Though this reflects progress from only 4% in 2009, it remains an area for improvement.[140] One barrier to high coverage of early infant diagnosis in Ethiopia has been uptake of this service at health facilities. The HEP's workers (HEWs and Women's Development Army volunteers) were utilized to mobilize communities and support mothers to bring their children to health facilities above heath posts for testing. Though turnaround time for receiving results has decreased from two to three months to about two weeks due to a sample transportation agreement with the national postal service, long wait times may continue to lead to mothers not returning to the facility with their children to receive results.

Treatment

Ethiopia's free ART program was introduced in 2005 with the technical support of PEPFAR and implementing partners and drugs supplied by the Global Fund. This program set a goal of increasing pediatric ART coverage to 90% by 2015.

Standardized training of health workers was provided by the FMOH's implementing partners. Mentorship and supportive supervision were also utilized at the facility level to support implementation. Mentorship was initially carried out by implementing partners, but after a number of years transitioned to hospital-based mentoring led by larger hospitals. A vertical, HIV-focused supportive supervision program was also put into place, resulting in regular joint visits conducted by the FMOH and implementing partners.

In order to improve access to ART in rural areas, ART services were decentralized to health centers and hospitals spanning all three levels of the public health system in August 2006. Health centers located in

high HIV caseload areas began providing comprehensive HIV care to both adults and children. These services were also provided at most primary, general, and specialized hospitals. The ART program began at eight facilities. It was scaled to 25 facilities in the first year, then to 60 in the next two to three years before being scaled nationally. By 2013, there were 1,047 HIV care clinics Ethiopia providing comprehensive care, including ART provision.[150]

Though ART coverage for HIV+ children has progressed since introduction of the national ART program in 2005, progress in treatment of children has lagged behind that of adults. A study of the program between 2005-2015 found that ART coverage among children under 15 living with HIV grew significantly from 1% in 2005/6 to 25% in 2014/15, reflecting progress, but an ongoing substantial gap in service provision remained.[151] By 2016, 61% of adults but only 35% of children living with HIV were receiving ART. Reflecting this overall progress, however, the number of children 0 to 14 years of age dying of AIDS-related illnesses declined by an dramatic 79% from 2002 to 2016.[152]

While the progress achieved during the study period has had a great impact on mortality as shown above, several factors may contribute to this slow progress relative to that of adult treatment. A key informant noted that these factors may include stigma around HIV, household prioritization of care for adults instead of children, limited access to health facilities providing pediatric ART, lack of testing for children, and lack of follow-up after testing.

ADAPTATION DURING IMPLEMENTATION

Beginning in 2006, ART services were decentralized to be provided at all three levels of the health system in order to improve access.

To support provision of ART to infants and children, the 2007 national guidelines prioritized improving linkages between pediatric, ANC, PMTCT, maternity, and adult care and treatment programs, as well as establishment of pediatric care teams at each site providing adult HIV/AIDS services. The guidelines detailed specific eligibility criteria for ART treatment.[134]

In 2014, the FMOH released the updated *National Guidelines for Comprehensive HIV Prevention, Care and Treatment*, which featured revised guidelines for ART utilization in infants and children. These guidelines strongly recommended that ART be started without delay for any infant with an initial positive virologic test result. In addition, ART eligibility was expanded to include all HIV-infected children less than 15 years of age, regardless of CD4 count and WHO clinical stage.[153]

SUSTAINMENT

The FMOH developed the *HIV/AIDS Strategic Plan – 2015-2020 in an Investment Case Approach* in December 2014. This plan identified low pediatric enrollment in ART as an area requiring improvement in the country. It established an ambitious target of 85% ART coverage of children living with HIV by 2020.[144]

Table 35: Early Infant Diagnosis and Treatment of HIV Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to determine burden	(+) In 2007, the FMOH estimated that 90% of pediatric HIV cases were attributed to vertical transmission from mother to child (+) Mortality among HIV+ children was high
Acceptability	Community engagement Stakeholder engagement Adapting global guidelines for local context	(+) Per key informant, coverage may be impacted due to stigma around HIV and household prioritization of care for adults rather than children.
Feasibility	Leveraging donor support	(+) Expansion of HIV testing and ART facilities including infants and children
Effectiveness and Coverage (Reach)	Decentralization of ART services to improve coverage in rural areas	(-) 2012 survey of five facilities in Amhara found that only 41% of HIV-exposed infants had blood taken for testing at or prior to 6 weeks of age. (-) 31% estimated coverage of early infant diagnosis in 2015 (+/-) Improved coverage of children under 15 receiving ART – 1% in 2005/6 to 25% in 2014/15, but still major gaps (+) Substantial decrease in related mortality in children between 2002 and 2016
Fidelity	Use of supportive supervision and mentorship	(-) Below-target coverage of testing (timing and testing) of HIV-exposed infants
Cost	Not found	Not found
Sustainability	Inclusion in national HIV/AIDS Strategic Plan – 2015-2020	Not found
Equity	Free service delivery Decentralization to improve access	Not found

4.5 Nutrition

4.5.1 Management of Severe Acute Malnutrition

Table 36: Management of SAM Key Implementation Strategies

Implementation Strategies

• National policy and planning
• Integration into systems and programs (including HEP)
• Free service delivery
• Decentralization
• Health system strengthening
• Leveraging partner and donor support
• Stakeholder engagement
• HR strengthening
  ○ Training
  ○ Supportive supervision
• Data use

EXPLORATION

Research has estimated that half of U5 deaths globally occur in children with malnutrition.[154] Though severe acute malnutrition (SAM) is a direct cause of U5M, children suffering from SAM are also more vulnerable to incidence of and death from other childhood illnesses such as diarrhea and pneumonia.[155] IHME estimated that in 2000, 6.3% of deaths in children under 5 in Ethiopia were attributed to malnutrition.[105]

The 2000 DHS reported that an estimated 1.4% of children under 5 in Ethiopia were severely wasted and suffered from SAM. Children living in rural areas had twice the rate of severe wasting (1.5%) as those in urban areas (0.7%). Rates of severe wasting also varied greatly by region, ranging from 0.5% in Addis Ababa to 3.1% in Gambella.[1]

PREPARATION

The FMOH adopted IMCI in 1997 as the country's main strategy for improving child health. Though IMCI does not typically include treatment of SAM, SAM was included in the expanded scope of Ethiopia's IMCI program, reflecting the goals to address major childhood illnesses in the country. Due to this integration, SAM management was included in pre-service training for health workers. As described in *Section 4.1.1* of this case study, the FMOH and implementing partners scaled IMCI across Ethiopia in 2001 after about four years of preparation.

Community-based management of acute malnutrition (CMAM) was first piloted in Ethiopia as part of a small study conducted in 2000. However, this approach was primarily used as an emergency response in the proceeding years. Following a food security crisis in the country in 2003/4, some international NGOs working in Ethiopia began to adopt this approach in order to treat the majority of SAM cases as outpatients due to the overwhelming number of children arriving at therapeutic feeding centers (TFCs) requiring treatment.[156]

In April 2006, the FMOH hosted a workshop in Addis Ababa to update national guidelines for management of SAM in preparation for scale-up of these services in Ethiopia. Stakeholders from local and international organizations, including UNICEF, the Ethiopian Paediatric Society, GOAL Ethiopia, and CARE participated in this development process through attendance of this workshop. One year later, the FMOH released updated guidelines for management of SAM. These guidelines established treatment protocols for SAM in inpatient and outpatient settings for infants under 6 months and children and adults older than 6 months of age. Notably, it permits outpatient management of SAM in the community. In addition to therapeutic feeding with F-75 and F-100 products during inpatient treatment and ready-to-use therapeutic food (RUTF) during inpatient or outpatient treatment, it also instructs health workers to provide SAM patients with antibiotics, vitamin and mineral supplementation (vitamin A, folic acid, and iron), and deworming. The document also features guidance on community mobilization activities to facilitate early case-finding and follow-up of children treated for SAM as needed.[157] At the community level, HEWs conducted community screening through house-to-house visits, Community Health Days, and at health posts, then referral to treatment programs.[158]

IMPLEMENTATION

The FMOH scaled SAM treatment services and by January 2008, 165 hospitals and health centers in Ethiopia provided in and outpatient treatment. At that time, management of these services was shared by the FMOH, UNICEF, and international NGOs.

In May 2008, the Oromia and SNNP regions reported substantial increases in SAM levels due to inadequate March/April rains and high market food prices. These challenges affected nutrition in 193 woredas, with an estimated 110,000 children in these areas affected by SAM at the time. In response, the national Emergency Nutrition Coordination Unit worked with the FMOH, UNICEF, and numerous international NGOs to implement emergency feeding programs in affected areas. However, availability of treatment was low – only 38% of affected districts were implementing emergency therapeutic feeding programs (TFPs) in July 2008.[159]

ADAPTATION DURING IMPLEMENTATION

Also in 2008, the FMOH decided to rapidly scale CMAM by decentralizing management of SAM to the health post level due to low coverage of TFPs and the higher than average burden of SAM in Oromia and SNNP. With this decision, the FMOH increased its ownership of SAM management services and planned to implement the CMAM approach within the existing health system on a permanent basis rather than as a response to emergencies.[158]

The FMOH aimed to first establish outpatient therapeutic programs (OTPs) at 1,239 health posts in 100 drought-affected woredas in Oromia and SNNP with financial and technical support from UNICEF. In preparation for establishment of these programs, it quickly developed guidelines and training materials with support from stakeholders. The FMOH, UNICEF, WHO, and NGOs conducted a training-of-trainers and trained all 2,478 HEWs in the 100 woredas in July and August 2008. This training included identification of SAM, referral of complicated cases to inpatient facilities, and management of uncomplicated cases of SAM at the community level. Following the training, district health offices conducted supervision and monitoring activities with the support of UNICEF and Population Service International. In addition, 32 nurses visited health posts to provide on-site supervision to HEWs and ensure high quality of care. Three months after conclusion of training activities, OTPs were operated at 455 health posts in 51 woredas. Establishment of OTPs at health posts improved service coverage from 38% to 65% in affected areas. However, supply chain challenges resulted in failure to reach coverage of the full 100 woredas planned due logistical challenges, particularly in supplying health posts with RUTF in the midst of a global shortage.

Though scale of the FMOH's initial efforts to expand services to health posts was limited, monitoring found that 27,739 children were admitted to OTPs in the 455 health posts that established programs between July and October 2008. Of these admissions, 78% were cured of SAM, surpassing international Sphere performance standards. Only 0.7% of admitted children died during this period, well below the Sphere standard of under 10% mortality. This monitoring demonstrated the feasibility of effective treatment of SAM at health posts by HEWs.[159]

The FMOH began implementing iCCM across Ethiopia within the existing HEP in 2010 as described in *Section 4.1.2*. Following iCCM's scale-up, SAM was managed free of charge at the community level across Ethiopia, improving access to these services. However, a study of children admitted to OTPs in 94 health districts in SNNP in 2011 noted challenges in management of SAM at the health post level. It found that upon discharge from the program, only 33% of children admitted with SAM met the recovery criteria of 15% weight gain or resolution of edema. Fourteen weeks after admission to the OTP, 40% of children admitted with SAM were still classified as having SAM, while 37% were classified with moderate acute malnutrition and 23% had normal nutritional status.[160]

By May 2011, CMAM services were expanded to 622 woredas in Ethiopia, including 8,100 health centers and posts providing outpatient services and 473 hospitals providing inpatient management. At the time, 61% of health posts and 52% of health centers in these 622 woredas offered OTPs. However, availability of services did vary by region, with higher coverage of OTPs at the health post level in Amhara, Tigray, and SNNP. The Afar and Somali regions had much lower coverage than the other regions, representing incomplete expansion of OTPs and Therapeutic Feeding Units (TFUs) due to the weaker health system and inadequate availability of functional health posts in these regions.

The FMOH reported continued high performance of the CMAM program. Between January 2008 and August 2011, the program surpassed international Sphere performance standards, with a recovery rate of

82.1% and a mortality rate of 0.7%. However, these performance indicators included all admitted cases rather than SAM cases alone.[161]

In 2015, the Government of Ethiopia declared the failure of the spring *Belg* rains, which impacted farmers and pastoralists across the country. After a government-led assessment the following October found that the expected harvest was below expectations due to El Nino, the government increased the number of top priority woredas for food assistance from 142 to 186. At the time, 400,000 children were estimated to have SAM. In response to these events, the government worked with UNICEF to increase the number of health facilities capable of treating SAM to 14,778 facilities by December 2015. In addition, it trained over 1,200 health workers and 13,000 HEWs on management of SAM. With the support of UNICEF, the government ramped up screening activities, screening 27.7 million potential cases within the first three-quarters of the year and achieving an average screening coverage of 87%. SAM admissions increased accordingly, with nearly 300,000 cases treated in 2015. UNICEF reported that the same year, 88% of SAM cases were considered cured.[162]

SUSTAINMENT

The 2016 DHS reported that rates of severe wasting in children under 5, or SAM, increased to 2.9%, compared to 1.4% of children in 2000. Regional rates of severe wasting were as high as 4.2% in Dire Dawa. Large differences by socioeconomic status were also reported, with the lowest rate in the fourth wealth quintile (2.0%) and the highest in the poorest wealth quintile (4.1%).[2] This increase likely reflected both external contextual factors (climate) as well as persisting gaps in capacity to deliver the needed services.

However, treatment of SAM in Ethiopia continued to be available at both the facility and community levels, with high sustainability due to its integration into the national FB-IMCI and iCCM programs. The 2016 SARA found that 84% of public health facilities reported offering diagnosis and treatment of malnutrition in children. At the community level, 82% of health posts offered this service.[73]

Table 37: Management of SAM Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for evidence-based decision-making	Expansion of SAM management
Acceptability	Community engagement and sensitization activities for improved case-finding and follow-up	Not found
Feasibility	Scale-up of SAM treatment services Integration into FB-IMCI and iCCM programs Leveraging partner and donor support Training for health workers	(+) National scale-up of SAM management through national scale of FB-IMCI and iCCM

Effectiveness and Coverage (Reach)	Decentralization of SAM treatment to health centers and health posts, improving access Integration into widespread FB-IMCI and iCCM programs	(+) High availability of SAM diagnosis and treatment at public health facilities (84%) in 2016 (+) SAM diagnosis and treatment widely available at the community level – offered in 82% of health posts (+/-) Variable recovery rates reported
Fidelity	HR strengthening – training and supportive supervision	(-) 2011 study found that a large portion of children admitted to health post treatment programs with SAM were discharged while still classified as having SAM[160]
Cost	Not found	Not found
Sustainability	Integration into FB-IMCI and iCCM	Not found
Equity	Free service delivery Improved access through treatment at health posts	Not found

4.5.2 Vitamin A

Table 38: Vitamin A Key Implementation Strategies

Implementation Strategies
• Community engagement • Direct supplementation • Integration into existing programs • Enhanced outreach strategy activities

EXPLORATION

Vitamin A deficiency is a widespread problem in children in many LMICs that contributes to U5M due to increased risk of illness and death from infections such as diarrhea and measles. Routine vitamin A supplementation for children 6 to 59 months of age is therefore recommended in areas with prevalent vitamin A deficiency.[163]

Following awareness of vitamin A deficiency in Ethiopia in 1959, a number of interventions focused on prevention and control of deficiency were implemented. From the 1960s through the 1980s, strengthened information education and communication and behavior change communication activities were conducted, including nutrition education material production, training nutrition field workers, and community awareness creation. Alongside these activities, production and consumption of vitamin A-rich foods was also promoted.

However, in 1980-81, a survey found that vitamin A deficiency was widespread in Ethiopia. In 1980-81, the Ethiopian Nutrition Institute found serum retinol levels were deficient in 44% of sampled children in this study. In addition, it found Bitot's spots, a sign of vitamin A deficiency, in 1% of individuals surveyed, twice the WHO cutoff value indicating a problem of public health significance.[164]

PREPARATION, IMPLEMENTATION, AND ADAPTATION DURING IMPLEMENTATION PRE-2000

Starting in 1989, the FMOH began to reinforce existing activities for vitamin A with targeted supplementation efforts.[164] In 1995, the FMOH with support from UNICEF began implementing universal vitamin A supplementation through integration with the country's EPI and Maternal and Child Health (MCH) services. Under this strategy, all children between 6 months and 1 year of age were given a single dose of 100,000 IU upon visiting health facilities, with biannual doses of 20,00 IU for children aged 1 and 5 years. In addition, vitamin A supplementation was provided to pregnant and lactating women and women of childbearing age. The program also utilized advocacy and sensitization activities to further increase awareness surrounding vitamin A deficiency and supplementation among health workers and mothers. An impact evaluation of this strategy was conducted in the northern and eastern regions of the country in June 1997. This study found improvement with a 66% and 43% reduction in prevalence of Bitot's spots in the northern and eastern regions, respectively.[165] Beginning in 1997, the FMOH changed its vitamin A supplementation strategy to twice-yearly distribution of capsules either as stand-alone campaigns or as part of National Immunization Days. Coverage of vitamin A supplementation reached approximately 70% in 1997 and 1998.[164]

PREPARATION, IMPLEMENTATION, AND ADAPTATION DURING IMPLEMENTATION POST-2000

Though coverage of vitamin A supplementation was high in the late 1990s, it dropped to 3% in 2000 and 2001 following the reported deaths of children who choked as a result of the whole vitamin A capsule being accidentally slipped into their mouths.

In April 2004, the FMOH initiated an EOS aimed at increasing the survival of children between 6 and 59 months of age in 14 woredas in the SNNPR region. Vitamin A supplementation was included as a main component of the strategy's package of services. The EOS provided these services through twice-yearly mobile campaigns which moved from kebele to kebele. This strategy was expanded to cover 59 woredas by August 2004, then in 2005 to 235 woredas at high risk for both drought and chronic food insecurity. This approach was effective, with coverage of vitamin A supplementation increasing to over 80% by 2006. As a result, the FMOH scaled the EOS activities to all districts in Ethiopia in 2007, targeting all children in Ethiopia between the ages of 6 and 29 months for vitamin A supplementation. A program coverage survey conducted in 2008 reported that the national coverage of supplementation in children in this age range was 94% with limited regional variability (from 82% in Dire Dawa to 99% in Tigray).[164]

To try to integrate the targeted activities into routine health services for sustainability, pilot districts in four drought-stricken regions transitioned implementation of a package of nutrition activities from the EOS to one utilizing Community Health Days. In this approach, HEWs conducted campaigns every three months, with vitamin A supplementation offered at the campaigns every six months. In 2013, districts

with a well-established practice of Community Health Days as well as urban woredas transitioned to use of routine services for administration of vitamin A supplements. Following this transition, nutrition services were provided by HEWs during health post and household visits as part of routine services. However, HEWs also conducted nutritional surveillance in their communities and were permitted to use methods such as "mini campaigns" as needed, in order to maintain high coverage. Though most regions adopted this integrated strategy, the EOS continued to be utilized in three highly pastoralist regions with low coverage of health services.[166] Despite these efforts, coverage of supplementation remained fairly low. Overall, coverage measured by DHS continue to decrease from 53% in 2011 to 45% in the 2016 DHS.[22]

SUSTAINMENT

The National Strategy for Newborn and Child Survival in Ethiopia 2015/16-2019/20 listed vitamin A supplementation every six months as a key intervention for child survival. It established a target of 95% coverage by 2020, compared to a baseline administrative coverage of 88% in 2013/14 which was notably higher than the DHS estimates in 2011 and 2016 possibly due to differences in data sources.[102]

Table 39: Vitamin A Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making	Widespread vitamin A deficiency in Ethiopia and low coverage of supplementation at start of study period
Acceptability	Advocacy and sensitization activities utilized	Community acceptance/refusal data not found
Feasibility	Inclusion of vitamin A in EOS Piloting of EOS as distribution method for vitamin A Integration into HEP after piloting	(+) Scale-up of EOS (+) High coverage across regions as seen below
Effectiveness and Coverage (Reach)	Expansion of coverage of EOS following initial piloting Transition to use of widespread HEP	(+) 94% national coverage in 2008, ranging from 82% in Dire Dawa to 99% in Tigray (-) DHS: coverage of 53% in 2011 and 45% in 2016
Fidelity	Not found	Not found
Cost	Not found	Not found
Sustainability	Supplementation every 3 months as key strategy of National Strategy for Newborn and Child Survival Integration into HEP Transition to provision as part of routine services	Not found

Equity	Use of EOS still utilized in regions with lower access to routine health services, even after transition to Community Health Days then inclusion in routine services in other regions	(-) Coverage varying by region in 2016 DHS (from 35% in Afar to 74% in Tigray)

4.6 Neonatal Interventions

4.6.1 Improving Antenatal Care Services, Access, and Uptake

4.6.1.1 Improving Access to Antenatal Care

Table 40: ANC Key Implementation Strategies

Implementation Strategies
• Data use for decision-making • Integration into existing programs (HEP) • Community-based care delivery • Free service delivery • HR task shifting • HR strengthening including training • Community engagement and education, including mass media

EXPLORATION

In 2000, the Ethiopian DHS reported that only 27% of women who gave birth in the preceding five years attended any ANC visits and only one in ten women attended at least four ANC visits. The survey showed large differences in utilization of ANC between urban and rural mothers (68% any ANC in urban versus 22% in rural). Rates of receiving ANC were lowest in the Somali and Amhara regions of Ethiopia (16% and 19%, respectively) and highest in Addis Ababa (83%). Disparities were also seen by education level with only 22% of mothers with no formal education receiving ANC from any type of provider, compared to 46% and 72% for mothers with primary and secondary or higher education, respectively.[132]

A national mid-term evaluation of Ethiopia's first Health Sector Development Plan conducted in 2002 showed slow progress towards achieving the country's health sector goals. Access to and utilization of health services, including ANC, in rural areas remained limited, affecting progress towards these goals.

PREPARATION

In response to the identified barriers of low access and low health literacy in the country, the FMOH launched the national HEP in 2003, as detailed in the Introduction. This program aimed to improve access to and utilization of essential health care through community-based health service delivery, including ANC.[59]

IMPLEMENTATION

As noted in the Introduction, beginning in 2003 the FMOH established a cadre of HEWs. Their training prepared HEWs to provide the four ANC exams and information for pregnant women, conduct home visits, and refer pregnant women with health problems to higher level facilities.[34,167] For most pregnancies, HEWs were expected to provide ANC themselves and encourage women to visit the local health center for delivery. For pregnancies with any potential risk, HEWs would refer the mother to a health facility for at least one ANC visit, then provide subsequent visits at the community level if risks were ruled out at the facility.

According to key informants, various activities at the community level were used to increase demand to address the traditionally low uptake of ANC services. HEWs in particular received training on promotion of ANC in their communities.[168] They also held monthly community meetings attended by every pregnant mother in the community and a midwife from the local health center. These discussion-based meetings were intended to improve health literacy of mothers around ANC and delivery and promote utilization of services provided by HEWs and at health centers.

ADAPTATION DURING IMPLEMENTATION

Following creation of the HDA cadre of community health volunteers, ANC was integrated into the discussion agenda for these volunteers. These volunteers aided in identifying pregnant mothers and linking them from the community to HEWs and facilities. Other mass communication strategies to promote ANC included use of the family health guide distributed to families, radio, and television.

Reflecting the low access and uptake, the FMOH also introduced significant health care financing reforms in 2005 to improve equity and utilization of health services broadly. Though implementation of these reforms varied by region, all included revision of user fee schemes, social and community-based health insurance, a waiver system for the poorest in the country, and standardized, exempted services to be delivered free of charge at health facilities. Maternity and family care services, including ANC, were made fee-exempt at the primary health facility level (health posts, health centers, and primary hospitals) as a result of these reforms. Despite this strategy to make ANC more equitable and accessible, gaps in equity remained a challenge as described below.[169]

The 2011 DHS conducted four years after full implementation of the HEP found variable change. Utilization of ANC services in Ethiopia had increased, for at least one ANC visit from 27% in 2000 to 43% in 2011, but limited increase in completion of four or more visits (10% in 2000 to 19% in 2011). While availability of these services at health posts was high – a 2007 assessment found that 83% of health posts offered ANC – uptake of HEW-delivered ANC was limited with only 9% of mothers reported receiving ANC from a HEW. Urban/rural inequity remained; ANC by a skilled provider remained at 76% of women in urban areas versus only 26% of women in rural areas. Regional differences were also seen, with coverage of ANC care from a skilled provider ranging from 22% in Somali to 94% in Addis Ababa.[72,167]

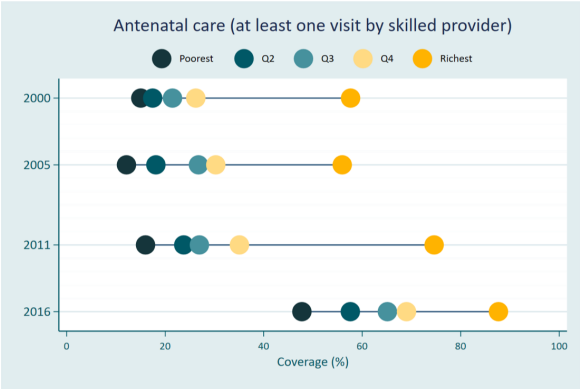


Figure 24: Receipt of Any ANC from Skilled Provider by Residence Type and Location, 2016 (Source: DHS 2016)

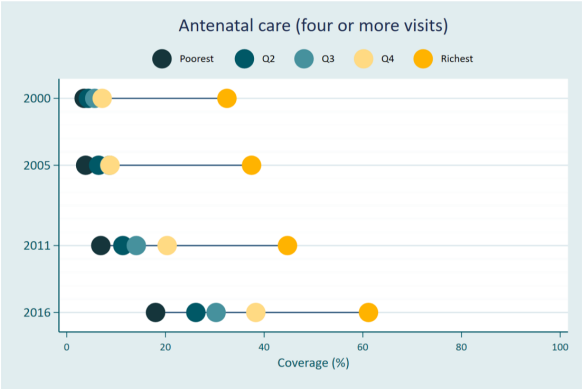


Figure 25: Equity and Coverage Outcome in Wealth Quintiles - ANC (at Least One Visit) (2000-2016) (Source: Victora et al 2018)

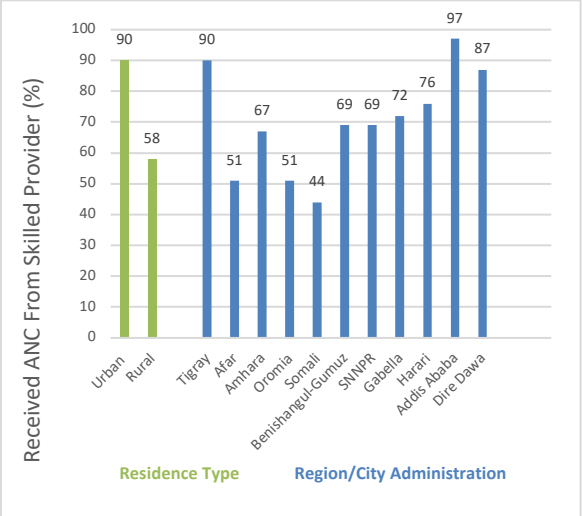


Figure 26: Equity and Coverage Outcome in Wealth Quintiles - ANC4+ (2000-2016) (Source: Victora et al, 2018)

In 2014, the Ethiopian SPA found high availability of ANC services nationwide – 87% of all facilities assessed (private and public, including health posts) offered ANC services, with the majority (74%) providing ANC at least five days a week. Availability of ANC services was generally high across regions, though lowest at facilities assessed in Gambella (49%) and Addis Ababa (45%). Though only a little over half of ANC providers (54%) reported receiving structured in-service training related to ANC during the preceding two years, actual availability of trained providers was likely higher than reported due to integration of ANC into pre-service training. However, only 33% of facilities offering ANC had ANC guidelines or protocols on management of common problems during pregnancy.[30]

The 2016 Ethiopia DHS showed impressive further increases in ANC uptake though with considerable room for improvement. 62% of women with a live birth in the previous five years received any ANC from a skilled provider while only 33% attended four or more visits. Utilization continued to vary by both residence type and region as shown in Figure 28. Women living in urban areas and in Tigray, Addis Ababa, and Dire Dawa were most likely to receive ANC from a skilled provider.[2] Though equity plots (Figures 26 and 27) show that utilization of any ANC by a skilled provider and receiving four or more antenatal care (ANC4+) visits increased across all wealth quintiles from 2000 to 2016, large gaps in equity between highest and lowest quintiles continued.

Despite increased availability and uptake of ANC services in Ethiopia over the study period, challenges in demand and acceptability remain. Early utilization has remained affected by cultural and social norms, since women who are aware of their pregnancy within the first 16 weeks may not seek care early in their pregnancy as many consider it taboo to share news of a pregnancy until it is visible. A key informant

explained that many women who do attend ANC do not have their first visit within this period. A 2015 study of women attending ANC clinic in Tigray confirmed that timely initiation of ANC remains a challenge – only 41% of pregnant women booked timely ANC and the median duration of pregnancy at the first visit was five months.[170]

Sustainment

Sustainment was included in the strategy of integrating ANC services are into the HEP, which remains the flagship program of the FMOH primary care strategy. The FMOH's National Reproductive Health Strategy 2016-2020 recognized the country's progress in increasing ANC care as well as the additional progress required. The strategy set a primary outcome target of increasing ANC4+ to 95% by 2020.[171]

Table 41: ANC Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for evidence-based decisions: In 2000, only 27% of women who gave birth attended any ANC visits and 1 in 10 attended at least four visits (DHS)	(+) Intervention introduction reflected identified need. In 2000, only 27% of women who gave birth attended any ANC visits and one in ten attended at least four ANC visits (DHS)
Acceptability	Community-based care delivery Free service delivery Community engagement and education including mass media	(Undetermined) Although data on acceptability was not found, the uptake of HEW-delivered ANC was limited despite increased access to these services at the community level, through inclusion of ANC in the scope of HEWs.
Feasibility	HR task shifting	(+) 87% of facilities assessed in 2014 ESPA+ reported providing ANC services
Effectiveness and Coverage (Reach)	Free service delivery Community-based care delivery HR task shifting	(+) Per DHS, utilization of any ANC visits increased from 27% in 2000 to 62% in 2016. (-) Low remaining utilization rates
Fidelity	Training: preservice and in-service	(-) In 2014, 54% of facilities providing ANC reported having at least one staff member who received in-service training for ANC care (-) Low availability of guidelines at facilities (2014 SPA)
Cost	Not found	Not found
Sustainability		(-) Persistent low ANC4+ rates with only 33% reach by 2016 (+) Improvement in ANC1+ rate with 62% reach by 2016
Equity	Free service delivery Community-based care delivery	(-) According the 2000 DHS and 2016 DHS, women in rural areas were less likely to receive ANC from skilled provider (22% and

		58%) in comparison to those in urban areas (68% and 90%) respectively (-) Regional variation from 51% in Afar to 97% in Addis Ababa (DHS 2016) (-) ANC by a skilled provider remained at 76% in urban areas versus 26% in rural areas.

4.6.1.2 Management of Pregnancy Associated Hypertensive Disorders (Including Eclampsia)

Table 42: Management of Hypertensive Disorders Key Implementation Strategies

Implementation Strategies
• Data use for decision-making • Data use to understand disease burden • Leveraging partner support • Guideline development • HR strengthening including through training

EXPLORATION

A study of 6,766 deliveries at Yekatit 12 Hospital in Addis Ababa from 1987 to 1989 found that 4.8% of pregnant women were pre-eclamptic and 0.3% were eclamptic. Of 327 pre-eclamptic women, 40.7% had severe pre-eclampsia. This study found that mothers with severe pre-eclampsia gave birth to a significantly higher frequency of low birthweight babies, a risk factor for neonatal death, compared to the mean birth weight of all deliveries.[172]

PREPARATION

The FMOH released the first edition of its Standard Treatment Guidelines for District Hospital in 2004. These guidelines recommended magnesium sulfate as a first line drug for prevention of convulsion among pregnant women with hypertension.[173] For severe preeclampsia, it recommended control of hypertension through use of antihypertensives (methyldopa or hydralazine, with nifedipine as an alternative).[173] To increase access, similar guidelines for health centers were issued to allow for methyldopa to treat hypertension, management for mild pre-eclampsia, and referral of severe pre-eclampsia cases to a nearby hospital.[173]

IMPLEMENTATION

Uncomplicated hypertension management

The FMOH's 2008 national emergency obstetric and newborn care (EmONC) assessment collected data at 797 health facilities, documenting a total of 174,561 deliveries. The assessment found high rates of stock

availability with antihypertensives were available at 75% of health centers and 99% of hospitals visited. Methyldopa, the first-choice drug for hypertension at the time of the assessment, was the most highly available drug and was found at 97% of facilities. Availability of hydralazine and nifedipine, also recommended for use by national guidelines, had fairly high availability in hospitals (70% and 82%, respectively) but lower availability in health centers (41% and 36%).[174] Pre-eclampsia and eclampsia were prevalent in 1 % of total deliveries and made up 5% of all complications. However, pre-eclampsia and eclampsia occurred in 16% of direct maternal deaths.

The national 2016 EmONC assessment also showed good availability of anti-hypertensives, with drugs available at 92% of surveyed health facilities. Methyldopa, the most widely available anti-hypertensive, was available in 74% of all facilities. Hydralazine was the most commonly antihypertensive used drug and was given in 33% of all cases.[175]

Eclampsia and peripartum management

Between April 2009 and July 2011, the FMOH partnered with the Ethiopian Society of Obstetricians and Gynecologists, UNICEF, the Pharmaceutical Fund Supply Agency, and Emory University to implement a project focused on reduction of maternal mortality by introducing magnesium sulfate in all public hospitals in Ethiopia years after its inclusion in national guidelines. Using a cascaded approach, this project trained a range of HCWs on magnesium sulfate use for prevention of mortality related to pre-eclampsia and eclampsia. At the regional level, obstetricians and midwives were trained from each hospital in the country. Though provision of magnesium sulfate at the health center level was permitted by national guidelines, widespread use at these facilities did not begin until after the study period and many health centers did not have magnesium sulfate.[176]

Despite being featured in national treatment guidelines since 2004, magnesium sulfate was under review for addition to Ethiopia's Essential Medicine List until 2012 and was finally included in the 2014 National Essential Medicine List. In 2014, 22% of facilities carried magnesium sulfate, double the rate in 2008 but still very low.[177] However, in 2016 the national EmONC assessment found stock-outs across all facility levels, primarily due to stock outs at central or regional stores or inadequate transport of supplies.[175]

Quality of care even when drugs were available was more variable. Provision of anti-hypertensives was documented in 48% of pre-eclampsia and eclampsia cases. Though 72% of facilities reported being "ready" to provide parenteral anticonvulsants, actual use in accordance with national guidelines when available was low at facilities. Only 26% of facilities reported providing parenteral anticonvulsants in the previous three months. Among facilities providing anticonvulsants, adherence to national guidelines was low with only 55% of the 1,002 facilities that had administered parenteral anticonvulsants in the previous three months using magnesium sulfate (the national first-line drug), with some using other drugs (29% of facilities used diazepam only and 15% administered both drugs).

ADAPTATION DURING IMPLEMENTATION

Additional guidelines for management of severe hypertension were featured in the 2010 Management Protocol on Selected Obstetric Topics, which provided additional, detailed guidance for providers. These guidelines established hydralazine as the drug of choice for acute therapy and methyldopa for maintenance therapy of elevated blood pressure. Nifedipine may be used as an alternative for acute therapy and for maintenance therapy.[178]

SUSTAINMENT

Not found.

Table 43: Management of Hypertensive Disorder Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data used to understand the disease burden	(+) 1987 -1989 study at Yekatit 12 Hospital in Addis Ababa found 1. 0.3% eclamptic and 4.8% of pre-eclamptic 2. Mothers with severe pre-eclampsia gave birth to a significantly high frequency of low birth-weight babies
Acceptability	Not found	Not found
Feasibility	Leveraging partner support for implementation ex. UNICEF	(+/-) Intervention implemented although challenges with availability
Effectiveness and Coverage (Reach)	Training	(+/-) High facility readiness (72%) but low provision (26% of facilities) of parenteral anticonvulsants with fairly low adherence to national guidelines - magnesium sulfate only used at 55% of hospitals that administered parenteral anticonvulsants in the 3 months preceding national EmONC survey in 2016 (-) Provision of anti-hypertensives documented in less than half (48%) of pre-eclampsia and eclampsia cases assessed in 2016
Fidelity	HR strengthening - training Guideline development	(-) Low availability of magnesium at facilities with frequent stock outs • Only 22% of facilities carried magnesium sulfate in 2014 • In 2016, 53% of facilities reported experiencing a stock out (+) High availability (92%) of antihypertensives at health facilities in 2016 (+) 2008 the national EmONC assessment found that anti-hypertensives were available at 75% of health centers and 99% and

		in 2016 EmONC assessment showed better availability of anti-hypertensives, with drugs available at 92% of hospitals visited. (-) in 2016 the national EmONC assessment found stock-outs across all facility levels, primarily due to stock out at central or regional stores or inadequate transport of supplies.[175]
Cost	Not found	Not found
Sustainability	Not found	Not found
Equity	Not found	Not found

4.6.1.3 Maternal Tetanus Vaccination

Table 44: Maternal Tetanus Vaccination Key Implementation Strategies

Implementation Strategies

• Data use for decision-making
  ○ Data use to determine disease burden
  ○ Monitoring and evaluation
• Leveraging partner support
• Community engagement and education including mass media
• Focus on equity
• National policy development
• Outreach, supplementary immunization activities

EXPLORATION

Ethiopia's EPI was launched in 1980 and included tetanus as part of the DPT vaccine from the start. However, vaccination coverage in the country has been low and erratic from EPI's launch in 1980 up to 2003 for various reasons, including socio-political events such as governmental transitions of power and the Eritrean-Ethiopian War resulting in low rates of tetanus coverage among pregnant women.

Globally, the Maternal and Neonatal Tetanus Elimination Initiative was launched in 1999 by UNICEF, WHO, and the United Nations Population Fund (UNFPA) with the goal of reducing maternal and neonatal tetanus cases. The initiative's 2000 strategy document identified 59 countries, including Ethiopia, that had not yet achieved universal neonatal tetanus elimination.[179] In 1999, WHO estimated Ethiopia had about 17,875 neonatal tetanus cases resulting in 13,406 deaths. At the time, the country contributed nearly 5% of all neonatal tetanus deaths globally.[78] IHME estimated that in 1999, tetanus accounted for 2% of deaths in neonates less than 7 days old and 7% of deaths in those between 7 and 28 days of age.[105]

PREPARATION AND IMPLEMENTATION POST-1999

Though immunization with at least two injections of the tetanus toxoid vaccine was integrated into ANC for pregnant women, coverage remained poor, likely due to low utilization of health services (including ANC) in the country. The 2000 DHS reported that the large majority (73%) of women who had a live birth in the previous five years did not receive any injection with tetanus toxoid during pregnancy. Only 17% of women received the recommended two or more injections during pregnancy.[1]

In 1999, the FMOH collaborated with EPI partners to begin implementing supplementary activities to administer tetanus toxoid vaccine in high risk areas, in addition to ongoing provision of the vaccine as part of ANC. Reflecting the low rates of ANC, it aimed to administer three doses of the tetanus toxoid vaccine to all women of childbearing age in these areas, with the long-term goal of maternal and neonatal tetanus elimination in the country.

To increase acceptability and uptake, the FMOH worked with Save the Children and UNICEF to implement a social mobilization program promoting tetanus toxoid immunization for women. This program was used to address false beliefs and rumors about the tetanus toxoid vaccine, reducing sociocultural barriers of vaccine utilization and increasing awareness of the importance of tetanus toxoid immunization with a goal of promoting a positive attitude towards immunization among both health workers and communities. IEC materials were multimedia reflecting the different needs of the communities. Print materials were distributed to all target audiences and group communication activities began in each district two months prior to launch of immunization campaign activities. In addition to print materials, these activities included newspaper ads and television and radio promotion of clean delivery practices and tetanus toxoid immunization. Mobile video vans also announced a short play and an hour-long film promoting practices including tetanus toxoid immunization. This film was shown in public spaces and followed by a question-and-answer session. The activities also engaged community, tribal, and religious leaders as key opinion leaders, along with health care staff, government workers, teachers, and NGO staff.[180]

Over 15 million women of reproductive age in 59 high-risk zones were immunized during three rounds of tetanus toxoid SIAs between 1999 and 2009. These activities achieved impressive two doses of tetanus toxoid (TT2) coverage ranging from 76% to 94% by zone.[74]

The WHO recommends validation of maternal and neonatal tetanus elimination status once a country has implemented all planned activities and claims to have achieved elimination. In 2011, a pre-validation survey was conducted by WHO and UNICEF to confirm whether Ethiopia had achieved maternal and neonatal tetanus elimination. This survey concluded all regions in in the country except Somali were validated for maternal and neonatal tetanus elimination.[179,181]

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

The FMOH planned to collaborate with RHBs, UNICEF, and WHO to complete a third round of SIAs in four high-risk zones of the Somali region. These activities were intended to help Ethiopia achieve complete validation of maternal and neonatal tetanus elimination in 2015/16.[78]

The National Strategy for Newborn and Child Survival in Ethiopia (2015/16 – 2019/20) strategy identified tetanus toxoid immunization during pregnancy as a high impact intervention for improving child survival. It set a coverage target of 90% of newborns protected against tetanus by 2020. This intervention was estimated to cost about $14.2 million USD total between 2015 and 2020.[102]

In 2017, a validation mission conducted by WHO and UNICEF concluded that Somali had achieved maternal and neonatal tetanus elimination. As all other regions in the country achieved maternal and neonatal tetanus elimination in 2011, the entire country became validated at that time.[181]

Table 45: Maternal Tetanus Vaccination Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to determine disease burden	(+) In 1999, Ethiopia contributed nearly 5% of all neonatal tetanus deaths globally. (+) In 1999, WHO estimated Ethiopia had 17,875 neonatal tetanus cases resulting in 13,406 deaths. Nearly 5% of all neonatal tetanus deaths globally. (+) 73% of women who had a live birth in the previous five years did not receive any injection with tetanus toxoid during pregnancy
Acceptability	Community engagement and education including mass media Leveraging partner support	(+) High coverage suggested high acceptability- see effectiveness and coverage
Feasibility	Leveraging partner support	(+) Immunization of 15 million women of childbearing age between 1999 and 2009
Effectiveness and Coverage (Reach)	Outreach/SIAs	(+) Maternal and neonatal tetanus elimination achieved in all regions (+) High TT2 coverage achieved during supplemental immunization activities conducted in high-risk zones (76-94%)[74]
Fidelity	Monitoring and evaluation	Not found
Cost	Not found	Not found
Sustainability	Policy development Data use for decision-making	(+) Elimination achieved and validated in 2017

		(+) The National Strategy for Newborn and Child Survival in Ethiopia (2015/16 – 2019/20) identified tetanus toxoid immunization during pregnancy as a high impact intervention for improving child survival. It set a coverage target of 90% of newborns protected against tetanus by 2020.
Equity	Focus on equity (targeting high risk areas)	(+) In 2017, all regions in the country were validated for maternal and neonatal tetanus elimination.[179,181]

4.6.2 Improving Childbirth Delivery Services, Access, and Uptake

4.6.2.1 Facility-Based Delivery and Skilled Birth Attendance

Table 46: Facility-Based Delivery and Skilled Birth Attendance Implementation Strategies

Implementation Strategies
• Data use for decision-making   ○ Data use to understand disease burden • Leveraging existing systems/programs • National policy development • HR task shifting • HR strengthening including through training • Free service delivery • Community engagement and education • Ensuring government financing • Improving physical access

EXPLORATION

In the 1950s, most facility-based births in Ethiopia were managed by community nurses, who had no formal midwifery training but managed maternity labor wards. The country's first formal midwifery training began in 1954 with the establishment of post-basic training for midwifery nurses at Gondar Hospital. In 1959, a full midwifery school was opened at Princess Tsehai Hospital in Addis Ababa. However, midwifery training at both Princess Tsehai and Gondar hospitals ended in the early 1960s.

In 1986, the Swedish International Development Agency supported opening of the new Addis Ababa Midwifery School. Trained nurses initially enrolled at the school to study midwifery in a one-year program and the school began offering direct entry into a midwifery diploma program in 1998. The country's first Bachelor of Science degree in midwifery began at the University of Gondar in 2000. The university began offering a master's level program in 2002. Several other institutions in Ethiopia additionally began offering diploma and BSc midwifery programs in the early 2000s.[182]

Despite these efforts to increase the workforce of skilled providers, deliveries at health facilities in which these providers worked remained low. In 2000, the Ethiopian DHS reported that only 5% of deliveries in the previous five years took place in a health facility. The likelihood of delivering in health facility varied dramatically by the region and type of residence of women. Thirty-two percent of women residing in urban areas gave birth in a health facility, compared to only 2% of women in rural areas. Women living in Addis Ababa were most likely to deliver in a facility (67%), followed by those living in Dire Dawa (31%), with women living in Amhara the least likely to have delivered in a facility (3%). Disparities were also reported based on education level and wealth. Only 16% of women with no education and 37% of those with primary-level education gave birth in a facility. Rates of facility-based delivery were much higher in women who achieved secondary or more than secondary education – 77% and 92%, respectively. Nationally, however, even at the highest wealth quintile only 25% of women gave birth at a health facility. Assistance by a skilled provider was also very low in 2000 – only 10% of births were assisted by either a health professional or a trained traditional birth attendant (5% of women had home deliveries with a Skillled Birth Attendant [SBA]). The majority of births (58%) were assisted by a relative or other individual, and 26% were assisted by a traditional birth attendant.[1]

PREPARATION

Overall, the FMOH's efforts towards increasing institutional and skilled delivery have focused on both the supply and demand sides, through increasing access to services, promoting these services, and increasing the number of providers available to provide them.

Following release of the MDGs in 2000, the Government of Ethiopia began to prioritize efforts to increase institutional skilled delivery in order to decrease maternal and child mortality. In 2004, the WHO African Regional Office (AFRO) convened a meeting to develop a "Road Map" for accelerated reduction of maternal and newborn morbidity and mortality in the region. One objective of this road map was to provide skilled attendance during pregnancy, childbirth, and postnatal periods at all health system levels. In order to help countries increase access to skilled care, AFRO organized an inter-country "Strengthening Skilled Care in the African Region" meeting the same year in collaboration with the International Confederation of Midwives (ICM). During this meeting, the 11 countries in attendance – including Ethiopia – developed minimum competencies for midwifery care, as well as a framework for development of midwifery care standards in the region. As part of this meeting, Ethiopia developed an action plan for strengthening midwifery care in the country.[183]

The FMOH also recognized the country's low rate of skilled birth care during delivery as a significant factor contributing to high maternal and newborn mortality rates. The FMOH's third Health Sector Development Plan (HSDP III), released in 2004 to guide country activities from 2005/6 to 2009/10, took steps to correct this barrier to improved outcomes. The plan identified the country's new outreach and community-oriented HEP as a strategy to reduce infant and child mortality. Under HSDP III, the FMOH planned to produce an additional 1,300 nurse midwives per year, over a period of six total years. This strategy aimed to improve the ratio of midwives to women of reproductive age from 1:13,388 to

1:6,759.[50] It set a target to increase the proportion of deliveries in the country attended by skilled birth attendants from 12% to 32%.

The FMOH released the Reproductive Health Strategy 2006-2015 in March 2006. A main strategy of this policy was ensuring access to a core package of maternal and neonatal health services (focused ANC, essential obstetric care, post-partum and neonatal care, and PMTCT), particularly in rural areas of the country. It set a number of targets for improving neonatal care in Ethiopia, including increasing the proportion of births attended by skilled health personnel at home or in a facility to 60% through increasing the number of trained health workers and improving access to facilities. Efforts to achieve this goal included equipping one health post per 5,000 population to provide essential obstetric and newborn care to increase facility-based deliveries, and one health center per 25,000 to provide BEmONC. The FMOH additionally aimed to equip one primary level hospital per 250,0000 population to provide CEmONC. This strategy also included a plan to amend the midwifery curriculum so that new graduates would satisfy the requirements of a skilled birth attendant.[184]

IMPLEMENTATION

In 2004, the HEP program trained its first class of HEWs who played a part to work to increase both supply and demand of facility-based delivery. Though HEWs were trained to assist delivery, their main role was to increase institutional delivery through promotion and by accompanying women to health facilities for delivery. By 2010, 33,819 HEWs had been trained and deployed and were estimated to reach 89% of communities in Ethiopia. In order encourage institutional delivery, the number of home deliveries in a community was included as one of the basic criteria used to evaluate HEW performance. As explained by a key informant in the FMOH,

> *"The heath extension workers, one of the basic criteria [by] which they are evaluated, is number of home delivery. If there are a number of home deliveries, that counts a lot against the health extension workers and the health sector which are very close to the community. They have made it like one big performance evaluation by making that something to be discouraged and so that tried to improve the facility birth."*[167]

Community engagement and sensitization activities were also conducted to promote institutional delivery and demand. In addition to promotion done by HEWs, for example, to show high level leadership commitment, parliament members visited communities to discuss facility delivery.

In addition to demand creation, the FMOH also sought to improve supply through a number of initiatives including infrastructure, increased HRs, and emergency transport. It focused on improving geographic access to health facilities through increasing the number of health centers in the country as part of a larger initiative to strengthen the PHC unit. By 2015, the FMOH had constructed 3,547 health centers throughout the country.[44]

To improve the number of skilled providers at facilities, the FMOH initiated the Accelerated Midwifery Programme in 2011 as part of the national Health Resource Strategy with the support of the UNFPA. The program's goal was to contribute to the attainment of MDGs 4 and 5 through rapid training and

deployment of skilled birth attendants at all health centers in an accelerated timeframe. The AMP trained clinical diploma-level nurses in a one-year diploma program in midwifery, using a curriculum centered on competency-based international standards established by WHO and the ICM. The program trained 4,461 new midwives over a three-year period, achieving 95% of its target.[185] Due to rapid expansion of midwifery education leading to increased annual graduation output, the number of midwives in Ethiopia increased to 9,244 in 2014.[186]

Identifying lack of transportation as an important additional barrier to facility-based delivery, the FMOH invested about $50 million to distribute a total of 1,250 ambulances throughout the regions of Ethiopia. To ensure sustainability and local ownership, prior to deploying the ambulances, the FMOH signed an agreement with the country's nine regions and two autonomous city administrations that the regional governments committed to allocate budgets to cover the running costs of ambulances, to replacing the ambulances after five years, and to make ambulance services available at no charge. At least one ambulance was deployed per district, with nearly half of districts receiving two ambulances based on their large size. An assessment that used retrospective household mortality surveys and ambulance logbooks in six randomly selected districts in Tigray for the period of May 2012 to May 2013 to assess pregnancy-related deaths found that the ambulances in the six districts completed 4,779 ambulance trips for deliveries. The overall percentage of deliveries utilizing ambulances was 25%, ranging from 6% in the Welkayat District to 53% in the Saesi Tsaedaemba District. Notably, lower use of ambulances for deliveries was found to be significantly associated with pregnancy-related deaths; pregnancy-related mortality in districts with above-average ambulance utilization was 149 per 100,000 live births, compared to 350 per 100,000 in those with below-average utilization.[187]

Despite significant efforts in increasing access to and promoting facility-based delivery, coverage of facility-based delivery was still low. Some of this was due to beliefs; a 2013 study found that women's reasons for choosing home delivery in a predominately rural area of the SNNP region in Ethiopia included the belief that institutional delivery was not necessary (42%) and not customary (36%) as well as high cost (22%) despite 2005 reforms removing user fees for maternal services. In spite of introduction of free ambulances to bring women to facilities for delivery, distance to care and subsequent cost of transportation and lodging remained a deterrent to facility-based delivery. Participants also expressed viewing traditional birth attendants as culturally acceptable and competent health workers while some perceived low quality of care at health facilities.[188]

Participants in a 2013 study examining delivery preferences noted high cost as a reason for not delivering at a facility, despite the removal of user fees for delivery services at primary level facilities in Ethiopia.[169] Aside from transportation costs when free ambulance services may not be available, a 2008 study utilizing the national EmONC assessment found that many facilities did not adhere to these reforms. It found 68% of facilities offering delivery services either charged a fee for normal delivery or required women to buy their own supplies. Over one-quarter (26%) of facilities charged a fee for normal delivery with an average cost of $7.70 USD. This study indicated that while the FMOH did enact policies to reduce financial barriers to institutional delivery, implementation and regulation of this policy was an area of improvement to truly improve financial access and reduce inequity.[189]

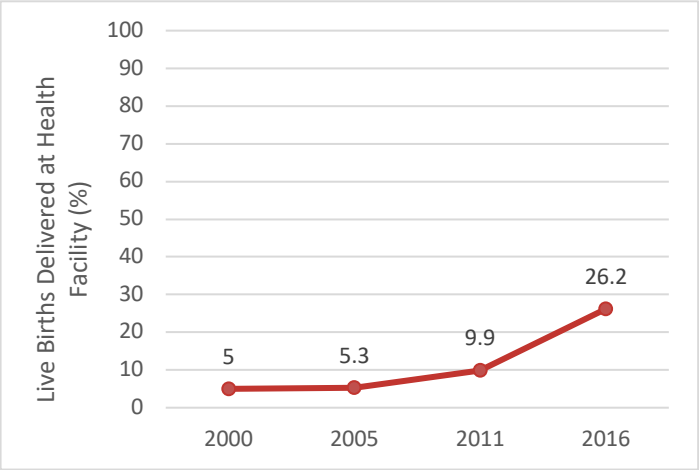


Figure 27: Live Births Delivered at Health Facilities in Ethiopia (2000-2016) (Source: DHS)

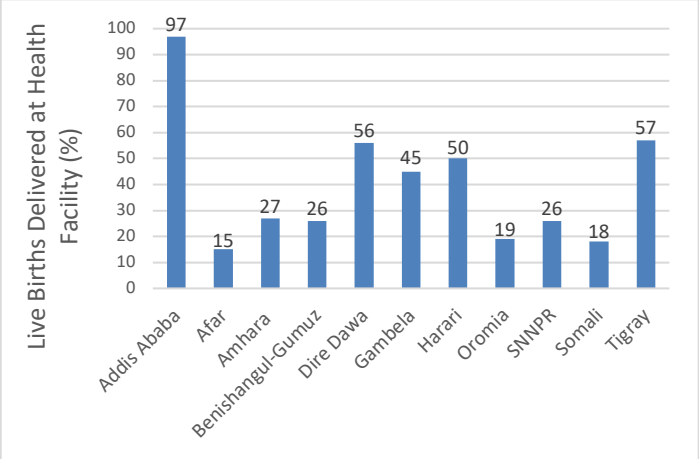


Figure 28: Live Births Delivered at Health Facilities in Ethiopia by Region/City Administration, 2016 (Source: DHS)

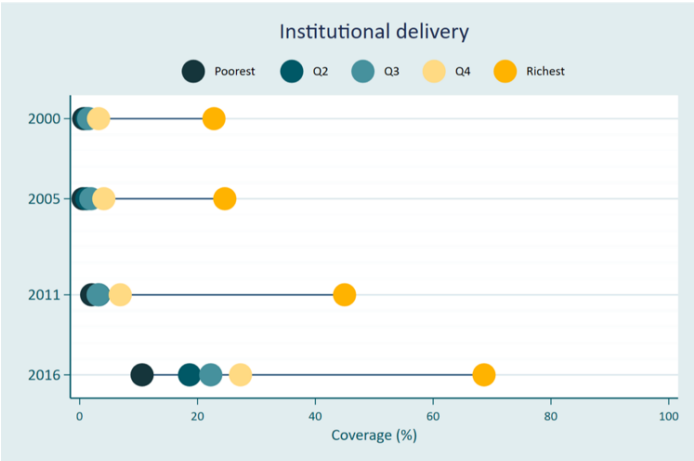


Figure 29: Equity Analysis of Institutional Delivery in Ethiopia, 2000-2016 (Source: Victora et al, 2018)

Excluding health posts, the 2014 ESPA+ found that availability of normal delivery services was very high for health centers (99%) and all hospital types (98%, 93%, 88% for primary, general, and referral hospitals, respectively). Nearly all (99%) public facilities provided normal delivery services.[30]

Despite the widespread availability in health centers and public facilities, the 2016 DHS reported that only 26% of women who gave birth in the preceding five years delivered at a health facility (although a large increase from 5% in 2000, see Figure 29). Regional rates of institutional delivery ranged from 14.7% in Afar to 97% in Addis Ababa (Figure 30). In addition, in spite of efforts of HEWs to promote institutional delivery in rural areas, the percentage of women living in these areas who delivered at a facility remained very low at 4%, compared to 50% among women living in urban areas.[2]

Equity plots show that institutional delivery increased in all wealth quintiles from 2000 to 2016. However, progress was greatest in the wealthiest quintile. Large disparities between the wealthiest and all other quintiles still exist, and the equity gap widened notably from 2000 to 2016 (Figure 31).

ADAPTATION DURING IMPLEMENTATION

As part of health care financing reforms introduced by the FMOH in 2005 to improve equity and utilization of health services, user fees for maternity services, including delivery, were removed at public primary level facilities (health posts, health centers, and primary hospitals).

SUSTAINMENT

The FMOH released the National Reproductive Health Strategy 2016-2020 in October 2016. As part of its strategy to improve access to and utilization of essential maternal and neonatal services, the policy established a performance target of declaring 75% of kebeles in the country as "home-delivery-free" by 2020. Planned interventions around maternal and neonatal services included increasing community awareness around the importance of facility delivery by strengthening activities of Women Health Development Armies and HEWs, strengthening primary level health care linkage and referral systems, and creating and strengthening mother-baby-friendly facilities.[171]

Table 47: FBD and SBA Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use to understand disease burden	(+) In 2000, only 5% of deliveries took place in a health facility, and only 6% of births overall were assisted by a trained health professional. (DHS) (+) In 2004, 99% of public facilities are capable to provided normal delivery services.[30]
Acceptability	Leveraging existing systems/programs- HEWs Community engagement and education	(-) Limited uptake of delivery services at facilities (-) Perceptions of institutional delivery remained negative
Feasibility	The HSDP III identified the utilization of HEWs in existing HEP to promote facility-based delivery Reform and expansion of midwifery training programs to rapidly increase number of trained midwives with additional 1,300 nurse midwives trained per year. Reproductive Health Strategy 2006-2015 in March 2006 Improving physical access Development Armies to strengthen PHC linkage and referral systems, and strengthening/creation of mother-baby-friendly facilities.[171] Ensuring government financing Leveraging existing systems/programs	(+) By 2010, 33,819 HEWs had been trained and deployed and were estimated to reach 89% of communities (+) increase in number of trained midwives from 1,275 in 2008 to 9,244 in 2014 (+) health centers (99%) and all hospital types (98%, 93%, 88% for primary, general, and referral hospitals, respectively (+) Increase in facilities providing delivery (+) Ambulances deployed across country (-) women believe that delivering at a health facility was: - not necessary 42%, - not customary 36% - very costly 22%.[188]

Effectiveness and Coverage (Reach)	HR task shifting Distribution of ambulances to all districts of Ethiopia to provide transportation to facilities for delivery Improving physical access	(+/-) Some improvement in institutional delivery and assistance by a skilled provider per DHS (+) Per 2014 ESPA+, 99% of public facilities offered normal delivery services
Fidelity	HR strengthening Training	(-) Policies enacted to reduce financial barriers to institutional delivery were not enforced. User fees for delivery services remained in place in many facilities[189]
Cost	Not found	Not found
Sustainability	Regional governments committed to create budgets for ambulance costs, maintenance, and replacement Investments in expanding skilled workforce and health facilities National policy development	(+) The FMOH released the National Reproductive Health Strategy 2016-2020 in October 2016. As part of its strategy to improve access to and utilization of essential maternal and neonatal services, the policy established a performance target of declaring 75% of kebeles in the country as "home-delivery-free" by 2020.
Equity	Removal of user fees Free ambulances to remove access barriers (geographic and financial) in rural areas	(-) 26% of facilities charged a fee for normal delivery.[189] (-) In 2000: 1. 32% in urban areas gave birth in a health facility, compared to only 2% in rural areas 2. Those who live in Addis Ababa were most likely to deliver in a facility (67%), in Dire Dawa (31%), in Amhara (3%). (-) In 2016, proportions of facility-based over the previous five years vary widely by location, wealth, and urban/rural location[22] delivery ranged from 14.7% in Afar to 97% in Addis Ababa (-) Equity gap widened notably from 2000 to 2016 (IHME)

4.6.2.2 Basic emergency obstetric and newborn care (BEmONC) and comprehensive emergency obstetric and newborn care (CEmONC)

Table 48: BEmONC and CEmONC Key Implementation Strategies

Implementation Strategies

• Data use
• HR strengthening
  ○ Training
  ○ Mentoring
• Leveraging partner support

EXPLORATION

In 1997, WHO, UNICEF, and UNFPA introduced emergency obstetric and newborn care (EmONC) as a strategy to reduce both maternal and newborn mortality, particularly in low resource settings. EmONC consists of basic (BEmONC) as well as comprehensive (CEmONC) care, which are used to classify health facilities. BEmONC consists of seven key services, or "signal functions":

1. Administration of parenteral antibiotics
2. Administration of parenteral anticonvulsants
3. Administration of parenteral uterotonics
4. Removal of retained products
5. Assisted vaginal delivery
6. Manual removal of the placenta
7. Newborn resuscitation

CEmONC includes these seven signal functions, as well as surgical capability (C-sections) and blood transfusion.[190]

The 2000 Ethiopia DHS reported that the country's maternal mortality ratio was 871 deaths per 100,000 live births. In addition, the infant mortality rate was 97 deaths per 1,000 live births.[1]

PREPARATION

Within one year of the WHO introduction, the EmONC strategy was introduced in Ethiopia as a component of the Save the Mothers Project supported by the International Federation of Obstetrics and Gynecology's Save the Mothers Fund. The project was launched by the Ethiopian Society of Obstetricians and Gynecologists and the Swedish Society of Obstetrics and Gynaecology in the West Showa Zone of Ethiopia in 1998. It was intended to demonstrate the feasibility and impact of Emergency Obstetric Care (EmOC) implementation intervention in Ethiopia on reducing maternal deaths.[191]

The FMOH coordinated governmental agencies, NGOs, stakeholders at multiple levels, and community members to develop the National Reproductive Health Strategy 2006-2015. One of several targets set to support the policy's strategy of ensuring access to a core package of maternal and neonatal health services, especially in rural areas, was to equip one health center per 25,000 population to provide basic EmOC and newborn care. In addition, the strategy aimed to equip one district hospital with 250,000 catchment population coverage to provide comprehensive EmOC. Key actions of this strategy included implementing solutions and support networks for transport to EmOC services and increasing the number of health officers trained on comprehensive EmOC.[184]

In 2008, the FMOH, coordinating UN partners (UNICEF, WHO, and UNFPA), and the Ethiopian Society of Obstetricians and Gynecologists began planning the largest ever national assessment of EmONC services to generate evidence for health sector planning in coordination with the national planning schedule. The assessment was funded by the three collaborating UN agencies and led by the FMOH. As this assessment

only included one neonatal-focused signal function (neonatal resuscitation), it utilized BEmOC and CEmOC rather than BEmONC and CEmONC as indicators. It included 806 hospitals, health centers, and higher-level clinics in the public and private sectors. Facilities were classified based on having performed the seven signal functions for BEmOC or these functions plus obstetric surgery and blood transfusion for CEmOC in the previous three months. Overall, large gaps in readiness were found.

- 90% of all facilities were categorized as "partially functioning" (missing 1-9 signal functions).
- 16 (14%) of hospitals were classified as fully functioning BEmOC facilities and 57 (51%) as CEmOC.
- Nine health centers (1.3%) were classified as fully functioning BEmOC facilities and one (0.1%) fully as CEmOC.
- Though WHO recommends at least five EmOC facilities per 500,000 population (of which at least one provides CEmOC), Ethiopia at the time was found to have only 0.6 EmOC facilities per 500,000 population.
- Geographic disparities were found, with EmOC facilities concentrated in the center of the country. Of 11 regions, only the Harari Region met the WHO goal. Addis Ababa met the minimum recommended number of CEmOC facilities but had no fully functioning BEmOC-only facilities.
- Reasons given by facilities for not providing a signal function included lack of supplies, equipment, or drugs, no patient presented with an indication for the function, lack of training, and other human resources issues.[192]

IMPLEMENTATION

Recognizing the large gaps in capacity for high-quality EmONC care in Ethiopia, the FMOH partnered with local and international stakeholders in 2010 to develop a standardized, competency-based BEmONC training curriculum for in-service training of midwives and nurses. Work also included strengthening systems in 2013 through a FMOH-led BEmONC-strengthening initiative to upgrade the capability of health centers to provide BEmONC. Through the BEmONC strengthening work, support was provided to 134 health centers covering 91 rural districts during the initiative's first phase in April 2013. This support included BEmONC training to health providers in the facilities, mentoring and monitoring through post-training follow-up, providing equipment and supplies, strengthening referral linkages, and improving infection prevention practices. An assessment was conducted in mid-2015 using a BEmONC implementation strength (BIS) index compiled from 12 programmatic input and process indicators. This index, which ranged from zero to 10, increased from a mean of 4.3 at baseline to 6.7. The health center delivery rate increased from 24% to 56% of all deliveries during the study period. Facility input indicators increased significantly over the study period, with the mean number of BEmONC-trained providers at a facility increasing from 1.4 at baseline to 2.6 at follow-up. However, the assessment reported only a 16% met need for BEmONC, based on the services provided and the expected number of women in the population with complications needing care.[193]

The 2016 Ethiopia EmONC Assessment collected data from 3,804 facilities across the country, and reported progress across all EmONC indicators between 2008 and 2016. In 2016, there was an increase in the number of fully functioning EmONC facilities recommended by UN standards, from 11% in 2008 to

40%. Only 13% of all births took place in fully functioning EmONC facilities. Despite the FMOH's efforts to improve EmONC and the progress seen above, the assessment indicated significant room for improvement, with a met need for EmONC of only 18% in all facilities. Additionally, met need varied greatly by region, ranging from just 3% in Gambella to 83% in Addis Ababa.[175]

ADAPTATION DURING IMPLEMENTATION

In mid-2013, a project was implemented by the Centre for International Health, University of Bergen, Addis Ababa City Council Health Bureau, and Addis Ababa University to assess the FMOH's newly developed curricula through training 82 midwives and nurses working in ten randomly selected public health centers in Addis Ababa. The training was not highly effective, with only 60% achieving knowledge-based mastery immediate post training which dropped to 40% of trainees after six months.[194]

SUSTAINMENT

The 2016 national EmONC assessment recommended prioritizing resources to the 31% of facilities identified as lacking only one or two signal functions to increase the number of fully functioning EmONC facilities in Ethiopia.[175] The HSTP for 2015/16 – 2019/20 recognized progress in coverage of EmONC services while also establishing goals for increasing availability of both BEmONC and CEmONC services in Ethiopia (availability of BEmONC from 56% of health centers to 100% by 2019/20 and CEmONC at hospitals from 83% to 100%).

Table 49: BEmONC and CEmONC Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Use of large national assessment to determine availability of BEmONC and CEmONC services prior to strengthening activities	Not found
Feasibility	Training health workers	(+) increased number of trained health workers (+/-) Improvement in proportion of UN-recommended standard number of EmONC facilities increased from 11% in 2008 to 40% in 2016
Effectiveness and Coverage (Reach)	Not found	(-) Very low coverage of births taking place in BEmONC facilities (-) Estimated only 16% met need for BEmONC services in 2015
Fidelity	Mentoring and monitoring through post-training follow-up Training	Not found
Cost	Not found	Not found
Sustainability	Prioritization of improving EmONC coverage in HSTP	Not found
Equity	Not found	(-) Geographic disparities in met BEmONC need

4.6.2.3 Caesarean Section

Table 50: Caesarean Section Key Implementation Strategies

Implementation Strategies
• National policy and planning • Workforce strengthening • Training • Task sharing • Focus on equity • Stakeholder engagement • Health system strengthening

EXPLORATION

Prior to 2015, global standards indicated that a national C-section rate between 10-15% could reduce maternal and newborn mortality. A lower rate indicates an unmet need of women requiring operative care to avoid maternal and newborn health conditions that can lead to mortality for both. However, Ethiopia's rate has remained far lower than this range. The 2000 Ethiopia DHS reported that fewer than 1% of all births in Ethiopia in the five years preceding the survey were delivered by C-section. Disparities were seen – 5.1% in mothers living in urban areas compared to 0.2% of mothers living in rural areas, though rates were uniformly low. Rate of C-section also varied by region, ranging from 7.9% in Addis Ababa to 0.1% in Amhara, although again all regions fell below the recommended rates at that time.[1]

Ethiopia's health system has long faced HR shortages, particularly in the area of surgical and anesthesia providers. It additionally had very limited access to emergency obstetric care, including surgical interventions. As explained by a key informant, *"Even if we have physical access, we do not have the surgeons. Most of the surgeons are in Addis, about 85% of the surgeons are in Addis and in some of the private hospitals. On the other hand, the rest [of the] surgeons are in bigger cities of the country like Mekelle, Bahir Dar, and Hawassa"*

PREPARATION

In 2009, the FMOH and Ministry of Education launched the IESO initiative to reduce maternal, prenatal, and infant mortality rates by using task shifting to address the country's surgical workforce shortage. Per a key informant, the scope of IESOs shifted during development of this initiative but provision of C-sections was an area of focus from the start.

> *"The plan was to train health officers to do obstetric emergency care then the idea came to be in college training why do we not add some emergency surgical condition like appendectomy and so then it grew up to comprehensive like that. Initially the idea was to improve surgical access for obstetric care mainly by that what meant is [C-section]."*

This initiative successfully established a cadre of mid-level, non-physician surgical providers called IESOs through establishment of a master's program in integrated emergency surgery. It aimed to avail one IESO per 100,000 population by the end of 2014 and to train and deploy 1600 IESOs competent in performing emergency surgical, gynecological, and obstetric procedures at 800 primary level hospitals by 2015.

The Health Sector Development Program IV was released in October 2010. To increase physical access to emergency surgical and obstetric services, this strategy aimed to upgrade selected health centers to primary hospitals. It defined a primary hospital as providing emergency surgical service, including C-section procedures. The policy additionally set a target of achieving a national C-section rate of 7% by 2015.[27]

The FMOH's national Management Protocol on Selected Obstetrics Topics, based on the WHO's goal-oriented model, was also developed in 2010. This protocol focused on essential antenatal, delivery, postnatal, and newborn care services. It set recommendations on C-section indications and required resources including presence of a trained provider, informed consent from the patient, and appropriate equipment and facilities.[157]

IMPLEMENTATION

The three-year IESO training program was launched in three universities in January 2009, admitting health officers with a Bachelor of Science degree and at least two years of work experience. Fifty-six health officers enrolled in the program's first year and by 2013, the training was expanded to 11 universities. Following completion of the training program, IESOs were deployed to primary and general hospitals across the country.

A study conducted in 2014 assessed clinical performance of IESOs in working in eight hospitals in the SNNP region of Ethiopia. Nearly two-thirds of all emergency operations performed at these hospitals between September and November 2014 were C-sections, all of which were performed by IESOs. C-sections accounted 12.5% of all deliveries during this period, within the globally accepted range. Labor abnormalities, fetal distress, obstructed labor, and malpresentations were the most commonly cited indications for performing a C-section.[195]

Ethiopia achieved fairly high availability of C-section delivery. The 2014 SPA found that at the primary level of the public health system, 77% of primary hospitals (the lowest-level facility equipped to provide this service) offered C-sections. Availability was higher in general (86%) and referral (84%) hospitals, which typically have higher surgical capacity.[30]

Though efforts such as the IESO program have improved access to C-sections at health facilities, the national and some regional rates remain very low due to low rates of facility-based deliveries. The 2016 DHS reported that the C-section rate remained lower than the FMOH's target of 7% by 2015 – only 1.9% of live births at health facilities in the preceding five years were delivered by C-section. However, the equity gap had increased sharply – 10.6% of mothers living in urban areas versus only 0.9% of those in rural areas delivered by C-section. The rate of C-section delivery ranged from 0.4% in the Somali region to

21.4% in Addis Ababa. Though the national rate, even among only facility-based deliveries, is much lower than the WHO-recommended rate, the rate is 23% in private facilities.[2] In 2015, WHO concluded that C-section rates higher than 10% are not associated with reductions in maternal and neonatal mortality ratios. Therefore, these much higher rates in Addis Ababa and particularly in private facilities suggest that unnecessary C-sections may be performed, while rates remain concerningly low in many areas of the country.

The FMOH reported slightly higher C-section rates for 2016 compared to the DHS. In 2016, the FMOH reported a national rate of 3%. It reported regional rates ranging from 0% in Afar to 35% in Addis Ababa. Rates in Harari (22%) and Addis Ababa (35%) were both higher than international recommendations but rates were lower than these recommendations in all other regions.[196]

ADAPTATION DURING IMPLEMENTATION

Creation of the IESO cadre was an important adaptation to improve access to C-sections in rural areas.

SUSTAINMENT

In 2015, the FMOH developed the national Saving Lives Through Safe Surgery (SaLTS) initiative in response to World Health Assembly resolution 68.15, which prioritizes strengthening emergency and essential surgical and anesthesia care as part of universal health coverage (UHC). This national surgical plan aimed to increase equity and access to a package of emergency and essential surgical services, which includes C-sections, at all levels of the health care system in Ethiopia.[197]

Table 51: Caesarean Section Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making Expanding access to C-sections reduce maternal and newborn mortality based on global standards on for Caesarean section rates to be between 10 and 15% prior to 2015	Fewer than 1% births in Ethiopia were delivered by C-section at start of study period (DHS2000)
Acceptability	Not found	(-) In 2016, low C-section national rates achieved at 3%, compared to the FMOH target of 7% by 2015.[27]
Feasibility	Task shifting with creation of a cadre of mid-level surgical providers (IESOs) to address national shortage of surgical providers The three-year IESO training program was launched in three universities in January 2009 HSS - upgraded selected health centers to primary hospitals.	(+) High availability of C-section delivery in 2014 (77% in primary hospitals, 86% in general hospitals, 84% in referral hospitals) (+/-) Variable- rates remained low in many settings but higher in urban

Effectiveness and Coverage (Reach)	Increased coverage of essential/emergency surgical services through IESO program Upgrading of health centers to primary hospitals to increase number of rural facilities providing C-sections and other surgical procedures	(+) Deployment of 136 IESOs throughout Ethiopia and 462 in training in 2015[198] (+/-) Increase in C-section rates in a few regions, per 2000 and 2016 DHS surveys but larger equity gap and decrease in some areas
Fidelity	Specialized training of new cadre	(-) C-section national rates at 3% in 2016, (FMOH) or 1.9% (DHS) is very low due to low rates of facility-based deliveries compare to the FMOH target of 7% by 2015.[27] (-) Rate of 21.4% of C-sections in Addis Ababa suggest unnecessary C-section
Equity	Planned deployment of one IESO per 100,000 population by the end of 2014 at primary-level facilities	(-) Inequities in C-section rates between regions and urban/rural (-) In 2016 the equity gap has increased 10.6% of in urban versus 0.9% in rural • 0.4% in the Somali • 21.4% in Addis Ababa.
Sustainability	IESO initiative Upgrading of health centers to primary hospitals to increase number of rural facilities providing C-sections and other surgical procedures Supportive supervision beginning in 2015 as part of SaLTS program Integration in strengthening emergency response	Not found

4.6.2.4 Clean Delivery Practices

Table 52: Clean Delivery Practices Key Implementation Strategies

Implementation Strategies
• National policy and planning • Integration into existing programs • Training • Partner engagement • Leveraging partners and donors • Supportive supervision • Mentoring • Supply chain strengthening • Integration into HMIS

EXPLORATION

UNICEF estimated that in Ethiopia in 2000, 12% of deaths in the first month of life were due to sepsis and 9.4% were due to tetanus.[199] Clean birth, clean delivery, and postnatal practices have been associated with decreases in neonatal mortality due to both of these causes. The WHO established "six cleans" that are typically included in clean delivery:[200]

1. Hand washing of the birth attendant prior to birth
2. Clean birth surface
3. Clean perineum
4. Cutting the umbilical cord using a clean implement
5. Clean cord tie
6. Clean cloth for drying

As noted above in the Facility-Based Delivery section, the 2000 DHS found that 95% of all births in the prior five years occurred at home, and only 6% of births overall were assisted by a trained health professional. As the large majority of births were attended by untrained individuals, coverage of clean delivery practices was likely quite low at the time, which could affect risk of important causes of neonatal mortality such as tetanus and sepsis.[1]

In the early 2000s, Ethiopia utilized the Marginal Budgeting for Bottlenecks (MBB) tool to identify bottlenecks affecting delivery of key interventions. It identified several main bottlenecks to maternal and neonatal care interventions, including clean and safe delivery: access to health facilities, shortage of skilled HRs, lack of essential equipment and supplies, inadequate motivation of personnel, and inadequate supervision.

PREPARATION

As a result, the FMOH's Health Sector Strategic Plan (HSSP) III 2005/6 – 2009/10 defined clean and safe delivery as a key high-impact health intervention to be integrated into service delivery in Ethiopia. The plan identified a baseline proportion of 10% clean deliveries and aimed to increase this proportion to 50% over the course of five years.[50]

IMPLEMENTATION

The FMOH implemented its maternal and child health package within the HEP. This package of services provided by HEWs included clean and safe delivery services at homes and health posts as a key element. A key informant noted that other facilities were by default providing clean delivery services as providers used standard sterility techniques. Work included increasing demand and supply for these services.

Beginning in early 2009, the L10K project implemented by JSI with USAID funding supported a program to provide HEWs with skills to promote essential newborn care practices (see below) in 101 of the country's 800 woredas, covering about 16% of the country's total population. HEWs trained and supported community health promoters from model families (see Introduction) who each provided maternal and

newborn health education to 25 to 30 households in their communities. These volunteer community health promoters used Family Health Cards featuring pictorial messages to promote essential practices, including clean and safe childbirth. Cross-sectional surveys were conducted in December 2008 and December 2010 to assess the impact of these essential newborn care interventions in 117 kebeles. Seven practice indicators were utilized to evaluate changes in maternal and newborn health indicators, including clean cord care. Some limited improvement was seen in all clean cord care practices, with the exception of cutting the cord with a sterile instrument. At follow up, 62% of home deliveries had tied the umbilical cord with sterile thread, compared to 58% at baseline. Though 68% of home deliveries at baseline applied nothing on the cord cut, this increased to 74% at follow-up. Overall, 46% took clean cord care, compared to 36% at baseline.[201]

In 2013, the FMOH launched the Community-Based Newborn Care (CBNC) program as part of the HEP in collaboration with UNICEF, L10K, IFHP, and Save the Children. This program aimed to reduce newborn mortality in Ethiopia by strengthening PHC units and the HEP through improved linkages between health posts and health centers and scaling up community-based maternal and newborn health services. As part of its implementation, the program scaled safe and clean delivery practices in health centers and health posts. The CBNC program utilized a two-phased approach. The program's first phase was implemented beginning March 2014 in all woredas of seven zones in Amhara, Tigray, Oromia, and SNNPR, which were selected based on the strength of their health systems. Phase I activities included preparation of training guides and other materials for health workers, HEWs, and HDA leaders, cascaded training, and regional and zonal-level orientations. Training was completed by all HEWs in these seven zones by August 2014. Follow-up was conducted after the training through regular supportive supervision and performance review and clinical mentoring meetings. Procurement and distribution of essential supplies and drugs supported program activities. Phase II of the program was launched in 2015, resulting in implementation in 70% of health posts in the country by the end of the same year.[202,203]

Since clean and safe delivery services are an activity performed by HEWs at homes or in health posts, clean delivery was integrated into the national HMIS as the proportion of births attended by HEWs at a health post, to be reported on a monthly basis.[204] According to the HSTP 2015/16-2019/2020, HMIS trends indicated that clean delivery increased in the preceding couple of years due to expansion of health centers, strengthening of health center-health post networks, and increased focus on provision of skilled care at birth.[44]

ADAPTATION DURING IMPLEMENTATION

In response to reportedly low demand for CBNC services, the FMOH worked with implementing partners and the MNCH community to develop the Demand Creation Strategy for Maternal Newborn and Child Health-Community-Based Newborn Care (MNCH-CBNC). It identified ten key approaches believed to increase community participation in MNCH-CBNC.[205]

SUSTAINMENT

The FMOH's National Strategy for Newborn and Child Survival in Ethiopia 2015/16-2019 shifted the Ethiopia's approach towards delivery practices. Possibly due to issues in HEW delivery skills according to a key informant, delivery by HEW was no longer included on the list of newborn and survival interventions in areas of the country with accessible health centers. According to a key informant, this change reflected the FMOH's shifting focus on promoting facility-based delivery rather than HEW-assisted deliveries to improve quality of care. As part of this shift in strategy, the FMOH promoted HEWs as agents to advocate for facility-based delivery in order to improve coverage of clean delivery practices provided at facilities rather than direct care providers.[102]

Table 53: Clean Delivery Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making	In 2000, 12% of deaths in neonates were due to sepsis[199]
Acceptability	Involvement of partners in development and implementation	Not found
Feasibility	HEWs trained and supported by community health promoters from model families Integration of existing HEP at homes and health posts. Improvement of community-facility linkages Maternal and newborn health education of households in communities Increase community participation in MNCH-CBNC Supply chain strengthening Partner engagement Expansion of health centers Testing program before national scale Regular supportive supervision, Performance Reviews and Clinical Mentoring meetings	(+) Expansion of CBNC to 70% of health posts nationally
Effectiveness and Coverage (Reach)	Expansion of health centers Integration into HEP	(+) Increase in clean delivery practices demonstrated by L10K program (46% vs 36% at baseline (+) Expansion to CBNC to 70% of health posts nationally

		(-) Limited progress seen in estimated mortality attributed to neonatal sepsis
Fidelity	Training and supportive supervision	(-) Uptake for deliveries remained < 100% (-) Limited improvement was seen in all clean cord care practices, with the exception of cutting the cord with a sterile instrument (+) Overall, 46% took clean cord care, compared to 36% at baseline.[201]
Cost	Not found	Not found
Sustainability	Integration in existing HEP FMOH's HSSP III 2005/6 – 2009/10 In 2013, FMOH launched the CBNC program for HEP Integrated into the national HMIS	Not found
Equity	Not found	Not found

4.6.2.5 Corticosteroids for Preterm Labor

Table 54: Corticosteroids Key Implementation Strategies

Implementation Strategies
• National policy and planning • Leveraging existing programs • Training

EXPLORATION

According to UNICEF, Ethiopia had an estimated preterm birth rate of 10 per 100 live births in 2010.[206]

IHME estimated that 32% of deaths among early neonates in Ethiopia were related to preterm birth in 2000.[105]

Antenatal corticosteroids (ACS) have been used since 1972 to accelerate fetal lung development and reduce risk of respiratory distress syndrome in pregnancies where a woman is considered to be at high likelihood of delivering significantly preterm. This practice has long been used in high-income countries prior to more recent introduction in LMICs during the study period.[207] However, a 2014 study found that in six LMICs, corticosteroid use was actually associated with increased risk of neonatal death. This outcome may have been related to inappropriate provision of corticosteroids in the intervention group.[208]

In 2015, WHO recommended provision of ACS therapy for women at risk of preterm birth from 24 weeks to 34 weeks of gestation under the following conditions: [209]

- Gestational age assessment can be accurately performed
- Preterm birth is considered imminent
- No clinical evidence of maternal infection
- Adequate delivery care is available
- Adequate care for a preterm newborn is available if needed

PREPARATION

FMOH's *Management Protocol on Selected Obstetrics Topics* was released in 2010. These guidelines, based on existing evidence and knowledge in the scientific and academic communities of corticosteroids as a lifesaving commodity, recommended use of corticosteroids at the tertiary level (specialized/referral) hospitals in cases of preterm labor to accelerate fetal lung maturity, except in cases with evidence of chorioamnionitis.[178]

IMPLEMENTATION

In Ethiopia, ACS use at a large scale began in 2014 following release of the national standard treatment guidelines expanding use for general and primary hospitals, as well as health centers. Following release of these guidelines, ACS was permitted to be given to mothers at risk of imminent preterm birth between 28 and 34 weeks' gestational age at all levels of the health system, and at all facility types except health posts. At health centers, pre-referral dose administration of ACS was defined as the standard with administration of full courses of ACS at primary, general, and specialized/referral hospitals. These guidelines also provided health care providers with information to help determine if the baby was preterm and the mother in labor, which had been a challenge in implementation of this EBI in clinical trial settings.[210] To ensure knowledge, ACS provision for women at risk of imminent preterm birth was included in both pre-service and in-service curricula for health care providers. It was also integrated into the FMOH's BEmONC training manual, which serves as a standard guide and resource for both pre-service and in-service training on BEmONC.

Although national guidelines permitted use of ACS across all levels of the public health care system, ACS therapy was still only more regularly utilized at specialized/referral and general level hospitals in the country during the study period. The FMOH's Ethiopian EmONC Assessment 2016 found that only 9% of health facilities had provided ACS in the previous three months. Of the 91% of facilities that did not provide ACS during that period, supplies (36% lacked corticosteroids) and trained staff (23% identified training issues) were the most common barrier to service provision.[175]

ADAPTATION DURING IMPLEMENTATION

Beyond study period.

SUSTAINMENT

The FMOH's National Strategy for Newborn and Child Survival in Ethiopia (2015/16 – 2019/20) identified provisioning of ACS for preterm labor as part of a package of high impact child survival interventions to be implemented nationally. The strategy provided a target coverage rate of 90% by 2020 and expected ACS provision to result in a 31% decrease in neonatal mortality among preterm infants under 36 weeks' gestation at birth.[102]

Table 55: Corticosteroids Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Global data used for evidence-based decisions. In 2000, IHME estimates that 32% of early neonates deaths in the country are related to prematurity.[105] Preterm birth rate of 10 per 100 live births in 2010 (UNICEF/ Ethiopia)[206]	
Acceptability		No refusal data found
Feasibility	Integration into BeMONC curriculum including diagnosis National guidelines	(-) Administered by few facilities at only at higher levels of care
Effectiveness and Coverage (Reach)		(-) National EmONC assessment in 2016 found only 9% of facilities had provided ACS over the previous three months
Fidelity	Training	(-) Stock outs
Cost		
Sustainability	Integrated into national guidelines	
Equity		(-) Availability of ACS at health facilities in 2016 varied by region – from 5% in Benishangul-Gumuz to 27% in Harari

4.6.2.6 Active Management of Delivery, Including Partograph

Table 56: Active Management of Delivery Key Implementation Strategies

Implementation Strategies
• Following international standards/recommendations • National policy and planning • Stakeholder engagement • Leveraging partner support

EXPLORATION

The WHO produced a partograph for improved management of labor in 1994 as part of the Safe Motherhood Initiative, which began in 1987. The partograph was recommended for use in routine monitoring of labor as it aids health care providers to identify slow labor progress and initiate appropriate interventions as needed.[211]

In 2003, the ICM and the FIGO (International Federation of Gynecology & Obstetrics) issued a joint statement on the *Management of the Third Stage of Labour to Prevent Post-Partum Haemorrhage.* The statement asserted that every birth attendant should have the skills, knowledge, and critical judgement to carry out Active Management of Third Stage of Labor (AMTSL), which consists of 1) administration of oxytocin or another uterotonic drug within one minute after birth of the baby, 2) controlled cord traction, and 3) uterine massage after delivery of the placenta as appropriate. In addition, required supplies and equipment should be available.[212]

An observational study conducted in late 2005 assessed use of AMTSL in facility-based deliveries in seven countries, including Ethiopia. The study found that 55% of midwives, 26% of nurses, and 20% of doctors reported receiving in-service training in AMTSL during the preceding 12 months. However, correct use of AMTSL was observed in only 4.5% of deliveries at the Ethiopian hospitals included in the study. A policy analysis conducted as part of the study found that while standard treatment guidelines included the definition of AMTSL, they provided conflicting guidance on provision of AMTSL. A training gap was also identified – though national guidelines featured AMTSL, AMTSL was not included in pre-service curriculum of doctors, nurses, and midwives.[213]

PREPARATION

In 2004, the FMOH and the Ethiopian Society of Obstetricians and Gynecologists released guidelines reflecting ICM/FIGO recommendations on AMTSL.

IMPLEMENTATION

The FMOH collaborated with the Ethiopian Society of Obstetricians and Gynecologists and IntraHealth International in 2003 to launch a one-year project focused on reduction of maternal morbidity and mortality by using universal application of AMTSL to prevent occurrence of post-partum hemorrhage. Large-scale training of health care providers on AMTSL proceeded conducted by the FMOH and partners. USAID's Prevention of Postpartum Hemorrhage Initiative conducted a national survey assessing facility-based management of the third stage of labor in 2006. The study observed 286 deliveries in 23 health facilities and found varying performance of aspects of AMTSL. Every woman whose delivery was observed was given a uterotonic drug during either the third or fourth stage of labor (rather than within three minutes of delivery as recommended) and most (68%) received oxytocin. Controlled cord traction (70%) and uterine massage (72%) were also observed for most deliveries. However, complete correct use of AMTSL according to the ICM/FIGO definition was observed in only 29% of deliveries, and only in 40% of cases when the definition of AMTSL is relaxed to be within three minutes of delivery. The study reported

dramatic regional variation in AMTSL with three of six regions showing no deliveries meeting either AMTSL definition.[214]

In 2010, the FMOH released the Management Protocol on Selected Obstetric Topics establishing AMTSL as standard management of third stage of labor, which should be received by every woman delivering at a health facility.[178]

Despite this work, gaps in knowledge of key tools and training coverage remained. Partograph use remained low as shown by a study conducted from February to March 2012. While all providers knew what a partograph was, only 53% of respondents correctly explained the function of the alert and only 20% knew the correct function of the alert line. In addition, use of the partograph was in just over half of respondents (57%). Providers who reported awareness of the partograph but never used it cited many reasons for non-use, including lack of knowledge, too much detail to fill, time consuming, and partograph use as the role of a doctor rather than midwives or nurses.[215]

The 2014 Ethiopia SPA+ also continued to report low levels of training in health providers – only 10% of interviewed providers of normal delivery or newborn care services in facilities excluding health posts reported receiving in-service training in AMTSL. Facility readiness in supplies was better with oxytocin, the uterotonic of choice in AMTSL, available in 76% of these facilities.[30]

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

Not found.

Table 57: Active Management of Delivery Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Following international guidelines	Not found
Acceptability	Not found	Not found
Feasibility	National guidelines established Partner engagement HR strengthening - large-scale training of health providers	(-) Low levels of training in health providers in 2014 (+) High availability of oxytocin
Effectiveness and Coverage (Reach)	Not found	(-) 2006 study: low coverage of correct usage of AMSTL
Fidelity	HR strengthening - training	(-) Low correct usage (29%) of AMTSL observed in 2006 study

		(-) Lack of training – only 10% of providers interviewed in 2014 SPA+ received in-service training on AMTSL (-) Poor provider knowledge of partograph
Cost	Not found	Not found
Sustainability	Not found	Not found
Equity	Not found	Not found

4.6.3 Improving Post-Partum Care

4.6.3.1 Neonatal Resuscitation

Table 58: Neonatal Resuscitation Key Implementation Strategies

Implementation Strategies
• Data use for decision-making • Leveraging existing programs • Stakeholder engagement • HR strengthening including through training

EXPLORATION

IHME's Global Burden of Disease 2017 estimated that in 2000, 34% of deaths among early neonates in Ethiopia were attributable to birth asphyxia.[105]

Prior to large-scale efforts by the FMOH, neonatal resuscitation was introduced by NGOs. A key informant noted that for much of the study period, "there was no attention from the government and the ministry itself" and many in Ethiopia assumed that neonatal care was very expensive despite the fact that the majority of neonates can be treated without sophisticated equipment.

A national baseline Emergency Obstetric and Neonatal Care (EmONC) assessment conducted in 2008 found that providers from 90% of hospitals had performed neonatal resuscitation in the previous three months. However, only 40% providers from health centers had performed neonatal resuscitation in the same period. Providers identified factors such as missing essential equipment and inadequate staff training as barriers to performing neonatal resuscitation in their facilities.[216]

An additional survey assessment was performed by the Maternal and Child Health Integrated Program in 2010 evaluated care in the 19 Ethiopian hospitals with the highest birth volumes. It found gaps in capacity to provide neonatal resuscitation – only 28% of surveyed providers had sufficient knowledge of neonatal resuscitation techniques and only 18% had ever resuscitated a newborn. While all 19 facilities stated that they performed resuscitation, only 77% had all of the essential equipment available.[217]

Helping Babies Breathe (HBB) was developed under leadership of the American Academy of Pediatrics in order to train birth attendants across the world in basic resuscitation and immediate care of newborns. The program was first launched in Tanzania in 2009, then worldwide in 2010, offering a standardized approach to increase competency.[218] The American Academy of Pediatrics disseminated the program to countries across the world, even bringing stakeholders from countries such as Ethiopia to the United States to promote it.

PREPARATION

In 2010, the FMOH developed a standard BEmONC curricula for in-service training in health facilities to address poor competency among obstetric and newborn health care providers. The FMOH worked with stakeholders such as the American Academy of Pediatrics, Global Development Alliance, and others to create a three-week training program that included the HBB intervention. The program included a full two days of training on HBB, with one day dedicated to skill building through use of the NeoNatalie simulator.[219]

IMPLEMENTATION

A national-level HBB "master trainer" program was conducted in Ethiopia in 2010. Trainings were held in seven Ethiopian cities for participants selected by the FMOH. Experienced health educators were selected to participate as they were expected to serve as national "master trainers". Participants completed a 2-day training consisting of both lecture and skill practice designed to teach participants HBB and provide them with skills needed to train others in the program. A study utilizing pre- and post-training knowledge tests found that HBB training significantly improved neonatal resuscitation knowledge among participants (68% more likely to identify infants requiring resuscitation, 75% more likely to correctly choose to begin ventilation in an apneic baby, and 79% more likely to appropriately attempt to improve mask seal when the bag-mask ventilation does not produce adequate chest rise).[220]

However, reach of the training was limited. The 2014 Ethiopia SPA+ reported that only 17% of surveyed providers at facilities excluding health posts had ever received in-service training on neonatal resuscitation. Rates of having received training varied from 7% in Somali to 36% in Tigray. In contrast, 43% of providers at health posts reported receiving in-service training on neonatal resuscitation due to its inclusion in annual integrated refresher training for HEWs.[30]

A 2016 assessment of EmONC in 3,804 facilities across Ethiopia found that 73% of facilities had performed neonatal resuscitation with bag and mask in the previous three months. However, this varied by region, from 88% of facilities in Benishangul-Gumuz providing neonatal resuscitation versus 42% in Afar. Overall 1-3% of newborns were resuscitated in most regions, except for Oromia, SNNP, and Gambella, in which fewer than 1% were resuscitated. Nationally, 70% of facilities were supplied and staffed for resuscitation, a 47 percentage point improvement from the 2008 baseline assessment. Provision of resuscitation also improved during this time period, with 71% of health centers providing resuscitation in 2016, compared to 38% in 2008. Even more impressive was the elimination of the training

gap which had been identified as a barrier in 2008, with 98% of facilities in 2016 having at least one staff member capable of providing neonatal resuscitation.[175]

Despite progress in expansion of neonatal resuscitation services in Ethiopia, IHME still estimated that 37% of deaths in early neonates in 2015 were attributable to birth asphyxia, showing no reduction in attributable deaths from the 2000 estimate of 34%. However, IHME estimated a decrease in the rate of death due to birth asphyxia as well as declines in the estimated number of deaths – 27,726 deaths in neonates were due to birth asphyxia in 2015, compared to 34,266 in 2000.[105] A key informant described the positive impact of expansion of this expansion in Ethiopia:

> *"Currently babies are not dying from easily treatable causes… Now I think health workers are not ignorant and they don't have also to classify babies who are not able to breathe as stillbirth but they do resuscitation. I hope the fact they do not classify as stillbirth is because of the program and the trainings."*

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

The FMOH's National Strategy for Newborn and Child Survival in Ethiopia 2015/16-2020 established a target rate of 90% immediate initiation of resuscitation with bag and mask for newborns who were not breathing spontaneously at birth by 2020.[102]

Table 59: Neonatal Resuscitation Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making	Per IHME, 34% of deaths in early neonates in 2000 were attributable to birth asphyxia
Acceptability	Not found	Not found
Feasibility	Leveraging existing programs Stakeholder engagement Adoption of established international program Training for health workers	(+) Increased knowledge of providers (+) 70% of facilities nationally staffed and equipped for neonatal resuscitation in 2016
Effectiveness and Coverage (Reach)	Not found	(-) Higher rates of neonatal resuscitation reported by key informant, but still low across regions per 2016 assessment[175] (-) Reach of training was limited (SPA 2014)
Fidelity	Supportive supervision	(+) 98% of facilities in 2016 had at least one staff member capable of providing neonatal resuscitation

		(+) Though data on quality of care was not found, a key informant noted *"whenever we have a supportive supervision we collected some data and that data showed us good number of babies are salvaged and more than 90% are resuscitated and saved"*
Cost	Not found	Not found
Sustainability	Inclusion in national policy	Not found
Equity	Not found	(-) Regional differences in facility readiness to provide resuscitation • 2016 EmONC assessment: resuscitation provided in highest percentage of facilities in Benishangul-Gumuz (88%) but lowest in Afar (42%)

4.6.3.2 Neonatal Intensive Care Units

Table 60: NICUs Key Implementation Strategies

Implementation Strategies
• National policy and planning • Stakeholder engagement • Health infrastructure and system improvement • Leveraging donor and partner support • HR strengthening including through training

EXPLORATION

A key informant noted that emphasis on newborn care was once very low in Ethiopia, explaining "*we had people saying that why do we need to worry about the small child because they do not survive anyways."* Though the FMOH historically did not commit as strongly to newborn health as it did to child health, the 2003 Lancet Child Survival Series emphasized the importance of addressing newborn care in order to achieve substantial under-5 mortality reduction. Following the release of this series, the FMOH began to prioritize newborn health with the support of partners such as the Ethiopian Pediatric Society, WHO, and UNICEF. However, progress to reduce neonatal mortality was slow, particularly compared to progress in reducing U5M. Ethiopia's NMR proportionally decreased only 38% from 1990 to 2010, compared to a 58% reduction of U5M over the same period, with a rate still high at 37 deaths per 1,000 live births in 2010. For a large part of the study period, availability of intensive care for neonates was very limited, with only a handful of NICUs operating at hospitals located in the larger cities in the country such as Addis Ababa, Gondar, and Jimma. According to a key informant, all other hospitals in the country typically turned away sick newborns requiring intensive care. Following the Lancet series, the FMOH began to

prioritize NICUs as a strategy to decrease neonatal mortality, sponsoring of a handful of small hospitals by partners to build NICUs, and advocacy by partners.

PREPARATION

The FMOH's Health Sector Development Plan IV 2010/11-2014/15 featured the country's first NICU Initiative. This strategy was developed to improve neonatal mortality in tandem with the Newborn Corner initiative as a result of advocacy by UNICEF and the Ethiopian Pediatric Society for prioritization of neonatal heath in Ethiopia.[198]

The NICU Initiative is a facility-based package of interventions aiming to reduce neonatal mortality and morbidity through improved management of neonatal complications and referral linkages. It established three levels of NICUs corresponding to hospital levels:

- Level I (Basic for district/primary hospitals): Equipped to perform neonatal resuscitation, evaluate and provide PNC for stable, healthy newborns born at 35 to 37 weeks, and to stabilize newborns born at less than 35 weeks or those who are ill until transfer to a facility providing a higher level of care.
- Level II (Specialty for regional/general hospitals): Equipped to provide care for infants born at more than 32 weeks of gestation weighing more than 1,500 grams who have physical immaturity, are moderately ill, or are convalescing from intensive care.
- Level III (Subspecialty for tertiary/secondary hospitals): Equipped to provide continuous life support and care for extremely high-risk newborns with complex and critical needs.

In addition to establishment of NICUs in hospitals across Ethiopia, the NICU Initiative aimed to strengthen capacity of providers to manage newborn health conditions and of facility supervisors to manage NICUs, ensure basic equipment and supplies were available at facilities, improve facility infrastructure, and strengthen referral linkages among facilities.[221]

IMPLEMENTATION

The FMOH utilized partnerships with various organizations and programs, including WHO, to establish NICUs in Ethiopia. A key informant noted the FMOH's commitment to and investment in establishing NICUs as a key facilitator of the intervention's success improving its feasibility.

The FMOH aimed to establish Level II NICUs at 90 hospitals by the end of 2015 and Level I NICUs at least at all hospitals by the end of 2016. It invested in purchasing equipment for new NICUs with the support of UNICEF. In 2014, the FMOH worked with partners such as the Ethiopian Pediatrics Society and WHO to develop protocols and training materials for NICUs. The Pediatrics Society and UNICEF supported the FMOH in conducting cascading national training for health workers. Training was supplemented by additional mentoring activities at the facility level. By mid-2015, 100% of target hospitals had received NICU training and 49% of NICUs were operational in Ethiopia.[221] However, further data assessing

readiness to provide NICU services and quality of care were not available at the time of case study development.

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

The 2015 National Strategy for Newborn and Child Survival in Ethiopia set an objective of ensuring effective universal coverage of high impact neonatal and child survival interventions. As part of this objective, the strategy emphasized strengthening of NICU services through training health workers, establishing a functional newborn corner in each health center and a NICU in each hospital, and ensuring availability of materials necessary to care for premature and low birthweight babies in these facilities.[102]

The FMOH also encouraged public facilities to establish and continue NICU services through the national facility assessments. As part of this assessment, facilities with high NICU performance are awarded points that contribute to their overall performance scores. Due to the national leadership and its focus on NICU services in assessments, a key informant noted the willingness of facility leadership and staff to establish NICUs and complete training, stating *"people are really very willing to commit to assign nurses and to their nurses to the training and supporting their doctors and nurses many times whatever they asked."* However, lack of adequate physical space for NICUs continues to be a challenge at many facilities. As explained by a key informant:

> *"The challenge is still space. We have challenges in physical space. There are still small rooms not [large] enough for the services and really, we have to fight [for] more space. We need kangaroo mother care and we need more physical spaces not only for the small babies but also for their mothers. Space is the most challenge we have, people did not think of space as vital and it is demanding."*

The FMOH's NICU work was additionally supported by the Institute for Healthcare Improvement beginning in 2015.

Table 61: NICUs Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for evidence-based decision-making Limited availability of intensive care for neonates throughout most of study period, with a handful of NICUs at hospitals in Addis Ababa, Gondar, and Jimma	(-) High NMR in Ethiopia – 39/1,000 live births in 2005 (UNICEF), leading to prioritization of neonatal care
Acceptability	Strong national leadership and inclusion of NICUs in facility assessments	(+) Per KI, high willingness of facilities to prioritize establishment of NICUs and staff training due to prioritization by FMOH

Feasibility	Strong leadership of FMOH to establish NICUs NICUs integrated in the Health Sector Development Plan IV 2010/11-2014/15 Newborn Corner initiative Creation of new NICUs Training and mentorship of providers to build capacity Strengthening of referral linkages among facilities[221] Partnerships to establish NICUs and train staff Stakeholder engagement Donor funding Leveraging local and international professionals	(+/-) 49% of NICUs functional by mid-2015 (-) Challenge in lack of physical space at health facilities
Effectiveness and Coverage (Reach)	Expansion of NICU services, aiming to establish units in all hospitals by 2016	(-) Mid-2015, 49% of planned NICUs were operational in Ethiopia
Fidelity	Training Post-training supervision in CBNC program to assess service provision	(+) 100% of target hospitals received NICU training by 2015
Cost	Not found	Not found
Sustainability	Leveraging continuing and new partners support post-2015 Inclusion in national policy National Strategy for Newborn and Child Survival in Ethiopia set an objective of UHC	Not found
Equity	Not found	Not found

4.6.3.3 Kangaroo Mother Care

Table 62: KMC Key Implementation Strategies

Implementation Strategies
• National policy and planning • Stakeholder engagement • Leveraging partner support • Integration into existing systems

EXPLORATION

Kangaroo mother care (KMC) began in Bogota, Columbia in 1979 as a simple, low-cost intervention for low birthweight infants.[222] The Tikur Anbessa Specialized Hospital in Addis Ababa, the country's largest public hospital, introduced KMC in Ethiopia in 1996 after one of the hospital's physicians learned about the practice in Mozambique.[223] In 1997, the hospital began using KMC as routine care for all neonates weighing less than 2000 grams.[173] As an early adopter, it participated in a large multi-center study including Ethiopia, Mexico, Brazil, India, and Italy which found KMC to be an effective, acceptable, and low-cost intervention for newborns.[224]

Following these results, the FMOH funded a randomized controlled trial to examine effectiveness of KMC at Tikur Anbessa Specialized Hospital over a one-year period from 2001 to 2002.[225] During the study period, a significantly lower percentage of infants in this study who were enrolled in KMC (23%) died during the study compared to those who received the conventional method of care (38%). Over 90% of mothers of infants included in the study reported that they were happy to care for their babies using the KMC method. Overall, this study provided the FMOH with evidence that KMC was effective, safe, feasible, and acceptable at health facilities in Ethiopia.[225]

PREPARATION

The FMOH published the first country's first Standard Treatment Guidelines for District Hospital in 2004. These guidelines feature an annex on KMC as a method of care for low birthweight infants.[173] In 2009, the KMC Trainee's Manual was published by the FMOH in collaboration with JSI and Save the Children.

IMPLEMENTATION

Years after its initiation at Tikur Anbessa Specialized Hospital, KMC was introduced at six hospitals in the Oromia, SNNPR, Amhara, Tigray, and Harari regions as part of Save The Children's Saving Newborn Lives program. More rapid scaling of KMC occurred with the expansion of NICUs across Ethiopia following integration into NICU services and trainings. Due to this integration, KMC was expected to be provided at all health facilities in the country with a NICU. A key informant explained that integration with NICU services improved the feasibility of KMC expansion, noting *"what makes it easy is integration with NICUs. NICU without KMC is not a real NICU, that I can say."* However, lack of physical space for both NICUs and KMC remains an ongoing challenge.

In 2014, Save the Children led an assessment which found large gaps in the readiness to provide and delivery of KMC and other services for premature and/or low birthweight babies at all hospitals and 19 randomly selected health centers in three zones of the Oromia and SNNPR regions. All hospitals reported providing KMC services within the three months prior to the assessment. However, the assessment reported a large unmet need for KMC: only 14% of eligible babies born in these hospitals were document as enrolled in KMC. At health centers, the most commonly cited reasons for not providing KMC were untrained staff, lack of equipment (despite no need for equipment), and low volume of low birthweight newborns. Fewer than 20% of delivery attendants in the facilities were found to be trained in KMC.

Although admission criteria for KMC was included in the FMOH's Essential Newborn Care Training Manual, this area was identified as a large knowledge gap in facilities. Only about half of all facilities were found to have amenities in place for that were suitable for extended KMC stays.[223]

These gaps were also reflected in the 2014 ESPA+ which found that 67% of facilities (excluding health posts) offering normal delivery services reported KMC as a routine component of newborn care. However, the availability of KMC was far from uniform across the country, ranging widely from 2% of facilities in Afar to 84% in Benishangul-Gumuz. Nationally, only 15% of providers reported receiving in-service training on KMC.[30]

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINMENT

The FMOH integrated KMC into the National Strategy for Newborn and Child Survival 2015/16-2019/20. This strategy identifies KMC as a key intervention and established a goal of KMC being initiated in 80% of low birthweight and premature newborns by 2013/14 (compared to 10% at baseline in 2010).[102] KMC was also included in the FMOH's 2015 HSTP and the Ethiopian National Health Care Quality Strategy 2016-2020.[44]

Table 63: KMC Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making • Multi-country study including Ethiopia • FMOH-funded RCT at Tikur Anbessa Specialized Hospital showing reduced mortality in neonates receiving KMC (23%) compared to those who did not (38%)	(+) Introduction of KMC in all regions
Acceptability	Counseling materials for new mothers to increase acceptance	(+) High acceptability by mothers following education per KI: *"Mothers are very willing but they have fear. The fear is they think that they can kill their babies because babies are there when they sleep and they could suffocate their babies… In our case, we have counseling methods like videos, audios, and posters in Amharic and other local languages."*
Feasibility	Partner engagement Inclusion in First Standard Treatment Guidelines for District Hospital (2004) as a method of care for low birthweight infants[226]	(+) See coverage below

	Integration into NICU services and training	
Effectiveness and Coverage (Reach)	Integration into national treatment guidelines	(+/-) 2014 ESPA+: 67% of facilities providing normal delivery services offered KMC
Fidelity	HR strengthening – training KMC Trainee's Manual published by FMOH in 2009	(-) Only 15% of providers surveyed in ESPA+ reported receiving in-service training on KMC (-) 2014 assessment: only 14% of eligible neonates born in a facility offering KMC were actually enrolled
Cost	Not found	Not found
Sustainability	Integration into NICU Inclusion in several national policies	Not found
Equity		(-) Significant regional variation in availability of KMC at health facilities in 2014 - from only 2% of facilities in Afar to 84% in Benishangul-Gumuz[30]

4.6.3.4 Management of Neonatal Sepsis

Table 64: Management of Neonatal Sepsis Key Implementation Strategies

Implementation Strategies

• Stakeholder engagement
• HR strengthening
  ○ Training
  ○ Supportive supervision
  ○ Performance review meetings
  ○ Clinical mentoring
• Leveraging of existing programs including through HEP
• Leveraging partner support
• Phased program introduction

EXPLORATION

In 2000, an estimated 12% of deaths in neonates were caused by sepsis. Though the FMOH promoted clean delivery practices during the study period through facility-based delivery and delivery by HEWs to prevent neonatal infections, management of neonatal sepsis was limited.

PREPARATION

In early 2012, a TWG established by the FMOH presented a strategy paper exploring the potential for community-based management of newborn sepsis, which analyzed potential benefits and challenges of introducing this strategy in Ethiopia. This paper recognized the growing proportion of U5 deaths in the neonatal period as well as challenges in identifying and treating sick newborns due to high levels of home delivery and seclusion of newborns due to cultural practices. In September of the same year, the FMOH agreed to introduce community-based management of newborn sepsis through the HEP. This decision was followed by a joint learning trip to Nepal attended by the FMOH and development partners to study the country's experience of scaling up newborn care at a national level. Following this trip, the FMOH led development of new national guidelines for CBNC within the existing HEP.

IMPLEMENTATION

The FMOH launched these new national guidelines in March 2013.[56] Simultaneously, it launched the national CBNC program in collaboration with UNICEF, L10K (JSI), the IFHP, and Save the Children. The program aimed to improve antenatal, intrapartum, postnatal, and newborn care by strengthening the PHC unit approach and the HEP. It scaled up community-based maternal and newborn health services in several areas, including management of neonatal sepsis and very serious disease at the community level as an early adopter of this strategy. The program was implemented in two major phases. Phase I was implemented in all woredas of seven zones in the Amhara, Tigray, Oromia, and SNNP regions, selected due to the strength of the zones' health systems. Phase II of the program was launched in January 2015 with the intention of ensuring national coverage. As described in the Clean Delivery Practice section of this case study, the program used a cascaded approach to train health workers, including HEWs. Follow-up via regular supportive supervision and performance review and clinical mentoring meetings was conducted following training activities.[66] By 2015, CBNC services were provided in 70% of health posts in Ethiopia, expanding provision of neonatal sepsis treatment in Ethiopia.[203]

A midline assessment of CBNC was conducted in November 2015. Four hundred and twenty-eight young infants were treated across 240 health posts over a period of three months. High rates of adherence to protocols were seen for less complicated cases – 95% of infants classified as having a local bacterial infection were treated with amoxicillin.[66] However, quality was lower for more complex cases including management of possible bacterial sepsis of newborns, an area of innovation in Ethiopia included in the iCCM program. Though CBNC protocol treatment of neonates with severe bacterial infection by HEWs includes pre-referral doses of amoxicillin and gentamycin, only 41% of very severe cases seen by HEWs at health posts were given both antibiotics.[66] Twenty-eight percent of cases were given gentamycin only, and 26% received only amoxicillin. Only 6% of infants with very severe disease were referred to a higher-level facility without a pre-referral dose of antibiotics.[66]

ADAPTATION DURING IMPLEMENTATION

Beyond study period.

SUSTAINMENT

Though beyond the study period, CBNC's integration into the HEP aids long-term sustainment of the program.

Table 65: Management of Neonatal Sepsis Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for evidence-based decision-making – 12% of neonatal deaths due to sepsis in 2000.[199]	(+) Expansion of community-based management of sepsis to address burden, high home delivery rates, and common practice of isolation following birth
Acceptability	Treatment by HEWs in the community	
Feasibility	Integration of community-based treatment into existing HEP as part of CBNC Implementing partner to introduce CBNC at national level Training of HEWs using a cascaded approach Implementation of national guidelines	(+) Expansion of CBNC to 70% of health posts in the country by 2015
Effectiveness and Coverage (Reach)	Introduction of community-based treatment at health posts	(+/-) In program midline assessment, 94% of infants with very severe disease were given a pre-referral dose of antibiotics
Fidelity	Training for HEWs Regular supportive supervision, Performance Reviews and Clinical Mentoring meetings	(-) Fairly low adherence to national treatment protocols in program midline assessment
Equity	Community-based services through HEP	Not found
Sustainability	Integration into HEP as part of CBNC program	Not found

4.6.3.5 Post-Partum Visits

Table 66: Post-Partum Visits Key Implementation Strategies

Implementation Strategies

• Stakeholder engagement
• HR strengthening
  ○ Training
  ○ Supportive supervision
• Leveraging of existing programs
• Community engagement
• Leveraging partner support
• Pilot testing and rapid expansion

EXPLORATION

The 2000 Ethiopian DHS Survey found that 90% of mothers who had a live birth in the five years preceding the survey received no PNC. Among the 10% who did receive PNC, 80% received the care within the critical period of the first two days postpartum. Mothers in urban areas were more likely to receive PNC (43%) compared with those in rural areas (6%). Utilization of PNC also varied by region, with 74% of mothers in Addis Ababa but less than 10% in the Afar, Amhara, and Oromia regions receiving care.[227]

In addition to limited uptake, research has suggested that some of the low utilization of PNC by rural women in Ethiopia may have been due to cultural beliefs and traditional practices such as the traditional 40-day confinement period intended to protect the mother and newborn from malevolent spirits.[228]

PREPARATION

The FMOH released Ethiopia's Reproductive Health Strategy in 2006. This strategy aimed to reduce maternal and neonatal mortality in Ethiopia through ensuring access to a core package of maternal and newborn health services, particularly in rural areas of the country with limited access to health facilities. This core package included post-partum and neonatal care.[184]

IMPLEMENTATION

The FMOH expects postnatal visits to occur at six hours, six days, and six weeks after birth. However, attendance at the health facility for the visit at six days after birth is traditionally very low as it is typically not culturally acceptable for women to leave the home at that time. As explained by a key informant, *"usually it is not culturally acceptable for the puerperal mother to come out of the home and in many parts of the country, they tend to keep them in [an] isolated room with curtain of cultural and traditional belief. Coming out and going to facility for a checkup is unthinkable."*

To increase uptake of PNC in consideration of these cultural practices, all HEWs in the country were trained to provide PNC in the community. Health centers sent notice of women in the community who had delivered at the facility to the health posts. HEWs were trained to follow up with all women in the community after delivery, ideally within four hours, for an initial postnatal visit. In addition to a number of activities focused on the postpartum mother, HEWs were trained to evaluate newborns for the following danger signs:

1. Inadequate breastfeeding
2. Neonatal jaundice
3. Fever, repeated vomiting, swollen abdomen, or no stool after 24 hours
4. Hypothermia
5. Respiratory distress
6. Bleeding from the umbilical stump or other site
7. Red swollen eyelids or pus discharging from the eyes[229]

HEWs were trained to conduct follow-up postnatal visits at the home at two days, six days, and six weeks post-delivery, in addition to a number of activities focusing on the postpartum mother.[167]

When the FMOH established the Health Education and Training (HEAT) program to upgrade the training level of the country's HEWs in 2011, one module on PNC was included. The HEAT program was primarily delivered through in-person training supported by printed training modules. Thirteen hundred HEWs were initially trained in the HEAT modules in a pilot project and the training was rapidly expanded to additional HEWs.[230]

Despite this work, the 2016 DHS found that only 19% of mothers who gave birth within the preceding two years received a postnatal check-up, only a slight increase from the DHS in 2000; most of these women delivered in a facility (42% of women who had a facility delivery received PNC versus only 1.9% who gave birth elsewhere). Only 27% of newborns born within the previous two years had at least two signal functions of PNC performed within two days after birth. Regional differences in coverage were also seen, ranging from 9% in Oromia to 55% in Addis Ababa.[2]

ADAPTATION DURING IMPLEMENTATION

Not found.

SUSTAINABILITY

The National Reproductive Health Strategy 2016-2020 set a target of improving this coverage to 95% by 2020.[171]

Table 67: Post-Partum Visits Implementation Strategies and Outcomes

Implementation Outcome	Implementation Strategy	Evidence
Appropriateness	Data use for decision-making	(+) Provision by HEWs due to low attendance at facilities and cultural norms to remain in the home after childbirth
Acceptability	Post-natal visits conducted by HEWs, who are members of the communities they serve	(-) Low uptake of PNC remains despite increased access through HEWs (-) Cultural beliefs and traditional practices such as the traditional 40-day confinement period intended to protect the mother and newborn from malevolent spirits limits care-seeking
Feasibility	Utilization of existing HEWs Training for HEWs and other workers Leveraging partner support	(+) Expansion of PNC service delivery through HEP
Effectiveness and Coverage	HR strengthening – training Leveraging widespread HEP	(-) Coverage remains low – per 2012 DHS, 86% of newborns did not receive a post-natal check at any point after delivery

	Stakeholder support	(-) Lower coverage of postnatal checks for newborns who delivered outside of a health facility (1% vs 34% of those delivered in a facility), despite service delivery by HEWs to provide home-based care
Fidelity	Post-training supervision in CBNC program to assess service provision Training HEWs and other health staff	(-) 2016 DHS: only 27% of newborns born within the previous 2 years had at least 2 signal functions performed within 2 days after birth
Cost	Not found	Not found
Sustainability	Integration into HEP Inclusion in national policy (National Reproductive Health Strategy 2016-2020)	Not found
Equity	Leveraging HEP present in rural communities across all regions, with training for all HEWs to provide PNC in the community	(-) Regional differences in coverage of postnatal checks within 2 days after delivery per 2016 DHS – ranging from 9% in Oromia to 55% in Addis Ababa

4.7 Regional variability and equity gaps for Disease Rates and EBI Coverage

Ethiopia had relative reduction in incidence of diarrhea, ARIs, and fever (50%, 73%, and 50%, respectively) at national level. At subnational level, the incidence of ARIs impressively reduced in all the regions (above 60%), but diarrhea and fever had variable reduction (between 24%-72% for diarrhea and 30%-76% for fever). The overall subregional equity gap for diarrhea (difference between regions with highest and lowest rates) reduced from 15.2% to 8.5%, while for ARI in the previous 2 weeks went from 19.2% to 7.3%.[1,2]

EBI coverage also varied across the regions by the end of the case study, generally with highest rates in Addis Ababa and lowest in Afar, although some variability was seen. For example: Pentavalent3 (95.7% Addis Ababa (80.5% next highest) to 20.1%), Measles (93.1 to 30.1), FBD (97% Addis Ababa (57% next highest) to 15%), and ORT (68% to 32%).[1,2]

Drop in regional equity gaps for some EBis were seen. This included ORT (gap from 49.8% to 36%, absolute drop of 13.8%), measles (77.7% to 63%, drop 13.3%). Others were relatively unchanged (ex. Pentavalent3 (79.4% to 75.6%) and others actually worsened (FBD: 64.1-82% (-17.9%, largely driven by large increase in Addis Ababa).[1,2]

Potential contextual factors which were identified as more common in the lowest coverage areas included lower female literacy,[1,2] higher proportion of pastoralist communities,[9] and border conflict.[231]

4.8 Common Implementation Strategies

Ethiopia was found to have utilized a range of strategies during implementation of EBIs. Many of these implementation strategies were shared across many or most EBIs.

Implementation strategies identified across multiple EBIs included:

1. Integration and leveraging of existing systems and programs
    - Building upon existing systems and programs for implementation of new EBIs, rather than using standalone approaches for implementation
        - Ex: new vaccines integrated into EPI's existing routine immunization schedule

2. Leveraging the Health Extension Program
    - Use of HEWs within the HEP with varying success to implement multiple key EBIs at the community level through a combination of demand generation (ex. community engagement, sensitization) and supply through care delivery with varying success
        - Ex: iCCM, routine vaccines, ANC, facility-based delivery, post-partum visits, ITNs

3. Data use for decision-making
    - Utilization of data from many sources throughout implementation of several EBIs, including:
        - Data use to understand disease burden and ensure appropriateness of EBI
            - Ex: use of local rotavirus surveillance in decision to implement the RTV
        - Data use for prioritization and feasibility
            - Ex: use of risk assessment mapping to implement phased meningococcal immunization campaigns, use of data to identify target areas for IRS

4. Leveraging and coordinating donor and partner support
    - Engaging implementing partners for support during planning and implementation of most EBIs
    - Use of donor and partner resources (funding and technical) to aid feasibility of widespread implementation

5. Community engagement and sensitization
    - Activities (often within the HEP) to engage and educate communities in order to improve acceptability and therefore utilization of services

6. Training for health workers
    - Training (in-service and pre-service) to strengthen skills of providers for many key EBIs
    - Large-scale national trainings utilizing a cascaded approach beginning with training-of-trainers to increase feasibility of training across the country
    - Integration of key intervention areas into pre-service training

7. Early and frequent stakeholder engagement
    - Involvement of international and local stakeholders early in preparation phase and throughout implementation

8. Pilot testing and rapid scale
    - Use of small-scale implementation and pilot studies (often implemented with partners) to inform large-scale implementation, followed by rapid national expansion for some EBIs

9. Health infrastructure and system strengthening
    - Widespread improvement of health infrastructure and the health system to improve service delivery and access
        - Ex: establishment of new health facilities (including health posts), creation of new cadres of health workers (HEW, IESO)

10. Leadership and setting clear goals and priorities
    - Incorporation of MCH and EBIs into national policy and planning documents as areas of prioritization

5 Cross-Cutting Contextual Factors (Facilitators and Barriers)

A number of contextual factors were identified as critical to implementing the EBIs associated with the drop in U5M in Ethiopia. These factors aided in creating the environment and providing the support that contributed directly or indirectly to Ethiopia's success or represented barriers for which the country at times adapted successfully but in other areas remained a challenge. Many of these contextual factors have also been identified in other Exemplars U5M case studies as facilitators or barriers to reductions in U5M.

These contextual factors can be organized broadly by whether they impacted U5M at the national, MOH, and global level, or at individual and community level:

Table 68: Contextual Factors

National, MOH and Global Level Contextual Factors	Effective National Leadership and Control: Setting Clear Goals and Priorities
	Donor and Implementing Partner Resources
	Economic Growth
	Investment in Health
	Strong Community Health System
	Ongoing Health Systems Strengthening Efforts
	Data Availability and Use
	Rising Private Health Sector
	Supply Chain
	Conflict
	Geography and Inequity of Coverage Across Regions
	Climate Change
	Low Utilization of Health Resources
Individual and Community Level Contextual Factors	Pastoralist Culture
	Women's Empowerment
	Nutrition Programming

5.1 Effective National Leadership and Control: Setting Clear Goals and Priorities (facilitator)

In Ethiopia, there is a reported strong political commitment to public service, capacity building, and decentralization, all of which were critical to effective EBI roll-out and the reduction of U5M.[232] Key informants reported that a focus at the national level on maternal and child health in particular was critical in reducing U5M. In efforts to reduce poverty and improve child health, the government developed strong, multisectoral plans with systemic prioritization of U5M, reflecting global goals in this area. Ethiopia was also an early adopter of the MDGs and integrated them early on into the broad developmental goals for the country.[232]

The government's strong commitment to U5M was reflected in national health policies. The National Health Policy of the early 1990s, which focused on decentralization, equal distribution of health, and health promotion and preventive care, laid the foundation for a series of HSDPs implemented throughout the study period. The HSDPs guided the FMOH's activities and set priorities for the health sector, including U5M. As explained by a key informant,

> *"almost 75% of our population is mothers and children and [these] people are vulnerable to diseases or any social problems. So, we are focusing on them and our health policy is really speculating that mothers and children are our priority and our strategies, also HSDP, prioritize maternal and child health and so even the current plan, [HSTP], focuses to improve the lives of mothers and children. As a developing country, we have very limited resources and we have to prioritize this group."*

Key health policies and strategies for U5M reduction in Ethiopia include:

- National Health Policy (1993)
- Health Sector Development Plans
    - HSDP I (1998-2002)
    - HSDP II (2003-2005)
    - HSDP III (2006-2010)
    - HSDP IV (2011-2015)
- National Strategy for Child Survival in Ethiopia (2005)
- National Reproductive Health Strategy (2006)

5.2 Donor and Implementing Partner Resources (facilitator)

Implementing partner and donor resources, both in the form of funding and expertise, were significant facilitators for many EBIs and, more broadly, U5M reduction in Ethiopia. Multilateral organizations such as GAVI and the Global Fund invested heavily in Ethiopia's initiatives for U5M reduction between 2000 and 2015.

In addition to financial resources, the FMOH also benefitted from technical and HR support provided by implementing partners, particularly in the preparation and implementation phases. Through engagement and leadership by the government, implementing partners often supported preparation activities such as adaption of international guidelines to fit the local context, developing training manuals, and conducting pilot studies. During implementation, these partners typically played a key role by providing trainings and scaling programs on behalf of the FMOH. For example, during implementation of facility-based IMCI, implementing partners (varying by region) provided trainings at the subnational level and also provided supportive supervision to facilities every three to six months.

Coordination of these partners and their resources was extremely important in ensuring that this remained a facilitating factor. As noted in the *Introduction*, the FMOH adopted a "one plan, one budget, and one report" approach. Under this approach, all parties involved in the health sector must align their

activities with the priorities of the government. This allowed the FMOH to guide resources, even those coming from international donors and partners, into its own priority areas, including maternal and child health. Rather than resulting in parallel programs, external resources in Ethiopia were leveraged to support government-owned and -led initiatives. While donor resources increased the feasibility of rapidly expanding interventions across a large country, continued dependence on donor funding may threaten sustainability of this work in spite of the government's strong leadership of health sector activities.

5.3 Economic Growth (facilitator)

Ethiopia experienced significant economic growth during the study period, leading to cross-sectoral investments, with the GDP reported to be growing at an annual rate of 10% since 2003,[232] facilitating many EBIs and reducing U5M. There was robust and rapid improvement of infrastructure, including road, telecom services, education, and water resources. Economic growth also fueled increased investment in higher learning institutions training health professionals, in turn boosting Ethiopia's health HR.[232] Ethiopia's economic growth was not reflected in increased proportion of investment in health from domestic sources as a share of total government expenditure. This measure fluctuated greatly during the study period, ranging from 9% in 2001 to only 2.1% in 2011, but overall it decreased.[233]

5.4 Investment in Health (facilitator)

Ethiopia's impressive investment in health, aided by donor funding as well as national spending, likely aided progress in reducing U5M by allowing the FMOH to strengthen the health system (see *5.6 Health Systems Strengthening*) and put money directly towards widespread introduction of key interventions. Ethiopia's total health expenditure dramatically increased over the study period from only $357 million in 2000 to $2.5 billion in 2015, reflecting increased funding for health received from external sources, which nearly doubled during the study period (14.8% of total in 2000 to 28.1% in 2015).[233] Meanwhile, government spending as a share of total health spending almost halved during this time, from 41.4% to 21.2%.[234] While Ethiopia's population experienced significant growth during the study period, it was accompanied by a large increase in health expenditure per capita, from $5 to $25 over the same period.

In addition to changes in amount and source of finances for health, important changes in the way resources were allocated, prioritizing PHC, also occurred. In 2007, the FMOH implemented the Health Care Financing Strategy. This strategy included several components for resource mobilization and allocation, including:

1. Revenue retention and utilization
2. Facility governance
3. Fee waiver and exemption system
4. Outsourcing of non-clinical services
5. Establishing a private sector to strengthen supply and delivery of quality health services

Prior to this strategy, government spending and allocation of resources tended to be biased towards hospitals and urban centers. However, after introduction of the HEP as well as this strategy, resources were more equitably allocated towards the local, primary level of the health system.[235] In addition to increased resource allocation towards the level of the health system delivering interventions intended to reduce U5M, spending on child health also improved. From 2005 to 2015, spending on child health programs doubled from $8 to $16 per capita.[236]

5.5 Strong Community Health System (facilitator)

Creation of the national HEP led to the establishment of a strong, comprehensive community health system across Ethiopia. This program was identified by several key informants as a key facilitator to reduction of U5M in Ethiopia. As it grew in scope, the HEP increased access to health education and promotion, preventive (ex: ITNs, immunization), and curative (ex: iCCM) services, particularly in rural areas of the country. Since the HEP soon became a widespread national program that reached many pastoralist areas traditionally underserved by static health facilities, it was often utilized as a platform for introduction of new programs (ex: iCCM) or for long-standing, facility-based initiatives that suffered from low coverage (ex: routine immunization, ANC, post-partum visits). As noted above, not all components were successful, including the use of HEWs for ANC, encouragement of FBD, and gaps in coverage, which varied by geographic region.

5.6 Ongoing Health Systems Strengthening Efforts

Besides direct EBI implementation, the Government of Ethiopia undertook significant efforts in multiple areas of public HSS during the study period, facilitating progress in many areas including U5M reduction. HSS work involved strengthening inputs, including facilities at multiple levels from hospital to remote health posts, and other efforts to improve geographic access, as well as HRs for health.

Geographic Access

HSS activities in Ethiopia included expansion of facilities in the primary level through construction of health posts and health centers as well as conversion of existing health centers to primary hospitals in order to increase access to primary health care across the country. In 1994 the public health sector included 82 hospitals, 288 health centers, and 1,311 health posts. By 2014, it grew to 111 hospitals, 2,689 health centers, and 14,416 health posts.[49] Further efforts to improve geographic access in rural areas included creation of free ambulance services for deliveries and other emergencies.

Human Resources for Health (Facilitator and Barrier)

Ethiopia has long suffered from a severe shortage of human resources for health (HRH), particularly in the rural areas in which most of its population lives. In addition to expanding facilities, the FMOH collaborated with the Ministry of Education to grow Ethiopia's health workforce. For some health worker cadres such as physicians and midwives, strategies included improving training programs and adding

additional training institutions to create more graduates. The FMOH also created new cadres of workers, particularly HEWs and IESOs, to support task shifting in order to alleviate the national HRH shortage and increase access to care. In particular, the FMOH progressively increased the role and responsibility of HEWs, who originally provided only health promotion and activities, to provide a number of health services key to U5M reduction.

Though the government prioritized the HRH issue and implemented various initiatives to alleviate this shortage over the study period, challenges in this area remain:

1. Skewed distribution of health workforce towards urban areas
   Despite the government's use of a "lottery mechanism" to deploy higher level cadres such as physicians and nurses to rural areas, these providers are still more likely to work in urban areas. This tendency leaves other regions, particularly pastoralist ones, with shortages of health workers. For example, in 2009 Addis Ababa had a ratio of one physician per 3,056 population. Oromia had one physician per 76,075 and Afar had one per 98,258. For health workers who do work in rural areas, many transfer to urban locations within three years and once again leave vacancies in the rural facilities.[31]

2. Health worker dissatisfaction and turnover
   Key informants expressed dissatisfaction among health workers in the public sectors, particularly with regards to salary, as a challenge. In 2012, 70% of doctors and nurses in the public sector reported being "completely unsatisfied." In addition to inadequate salary, health workers in Ethiopia may also be dissatisfied with lack of access to further training and promotion, lack of mentoring, and working conditions. This dissatisfaction can lead health workers to leave their posts at public facilities and join the private sector.[31]

5.7 Data Availability and Use (facilitator)

Ethiopia has a long history of valuing data and using it for planning, prioritization, and implementation of new initiatives. Many national surveys are conducted in Ethiopia, including the DHS, Service Provision Assessment (SPA), SARA, and MIS. In addition to these surveys, the FMOH uses data from the HMIS and local studies to inform many activities, including setting national priorities, determining appropriateness of interventions to address priority areas, and planning implementation of these interventions. For example, Ethiopia was an early adopter of the meningococcal A vaccine due to its location on the African meningitis belt and high burden of meningococcal disease due to recurring epidemics. During its preparations to introduce the vaccine, the FMOH used risk assessment mapping to plan phased immunization campaigns. This use of risk mapping allowed the FMOH to prioritize the highest risk areas of the country prior to implementation of campaigns across the entire country. As part of the HEP, surveillance data was collected at the community level including on communicable disease and maternal and child health indicators.

While Ethiopia's data availability and use facilitated U5M reduction, key informants expressed concerns about low data quality, particularly in the HMIS. This challenge in data quality was particularly seen for vaccines during the study period. For example, the FMOH reported a PCV3 coverage of 96% in 2015.

However, WHO/UNICEF estimated this coverage to be 69% and the 2016 DHS reported an even lower coverage of 49%. As data use has been an important strategy in Ethiopia's work to reduce U5M, inaccurate data may affect implementation of these interventions and ability to accurately measure coverage then use data to adapt the interventions for improved outcomes.

5.8 Rising Private Health Sector (facilitator)

Though Ethiopia has a large and growing public health sector that is the primary source of care throughout most areas of the country, the private sector also grew during the study period. In some areas such as Addis Ababa, private facilities have provided an increasing share of maternal and child health services. Despite this growth, the majority of initiatives during the study period continued to focus primarily on the public sector. A key informant explained that the private sector is somewhat loosely regulated and the FMOH did not have the capacity to provide support such as training for new EBIs to private facilities. However, this key informant noted that that the FMOH could no longer ignore the role of the private sector in management of childhood illnesses such as diarrhea and should explore working with the private sector in the future.

5.9 Supply Chain (barrier)

Coverage of some EBIs may be affected by persisting supply chain weaknesses leading to low availability of key commodities, particularly medicines. The 2014 ESPA+ identified low availability of many essential medicines (amoxicillin, paracetamol, zinc, and ACT) for iCCM at health posts. Availability of these medicines for facility-based IMCI was higher, though zinc and vitamin A capsules were available at less than half of facilities (excluding health posts). Gaps in availability of vaccines were also noted. While most facilities providing child immunization services had individual vaccines in stock, availability of the entire set of basic child vaccines (pentavalent, oral polio, measles, BCG, and PCV) was much lower. Just under 24% of health posts possessed all basic child vaccines at the time of the assessment, though availability was higher at health centers (58%). These issues in availability of commodities such as essential medicines and vaccines likely affected coverage and quality of key child health services.

5.10 Conflict (barrier)

From 2000-2015, Ethiopia experienced frequent conflicts with neighboring countries Eritrea and Somalia, with significant conflict and displacement also occurring after the study period concluded. In areas experiencing conflict between Eritrea and Ethiopia, including in Tigray, Afar, and Somali, there was significant population displacement, which was found to negatively impact height-for-age in children. However, research conducted from the period of 2000-2013 found that there was no increase in wasting in areas affected by conflict compared to those unaffected.[231]

5.11 Geography and Inequity of Coverage Across Regions (barrier)

Ethiopia is a large country in both geographic area and population, with a large population living in rural as well as pastoralist areas. The geography of Ethiopia and presence of hard-to-reach pastoralist

populations in several regions of the country have been major challenges for many years in the work to reduce U5M with regards to access and equity. Though Ethiopia has successfully scaled many EBIs across the country, gaps often remain in both the level and equity of coverage. Many EBIs are now implemented at a national scale, but still have not achieved comprehensive reach. For example, while the measles vaccine has been implemented since 1980, WHO/UNICEF estimated national coverage to be only 65% in 2015. While for many EBIs increases from very low coverage at the start of the study period likely still contributed to impressive reductions in U5M, coverage remains an ongoing challenge to further progress. This is especially the case in regions such as such as Afar and Somali, compared to other regions that have achieved high coverage. U5M has declined across all regions, but it still remains substantially higher than the national rate in some regions, particularly pastoralist ones (see Figure 32).

Possibly contributing to these differences, regional coverage of many interventions intended to reduce U5M varied dramatically by region. In addition to varying access to health services, inequities may be due to regional differences in strength of the health system delivering these interventions, with pastoralist regions suffering in this area according to key informants. Though the HEP was intended to improve access to health services in areas of the country with low geographic access or weak health systems, disparities in coverage still remain, particularly in pastoralist regions such as Somali and Afar. For example, administrative coverage of three doses of the pentavalent vaccine was high in regions/city administrations such as Addis Ababa (96%), Dire Dawa (87%), and Tigray (81%) but was significantly lower in Afar (20%), Somali (36%), and Oromia (40%). While the FMOH did implement outreach activities to increase coverage in pastoralist areas, inequities in coverage continue to present a barrier to overall high and equitable coverage in the country.

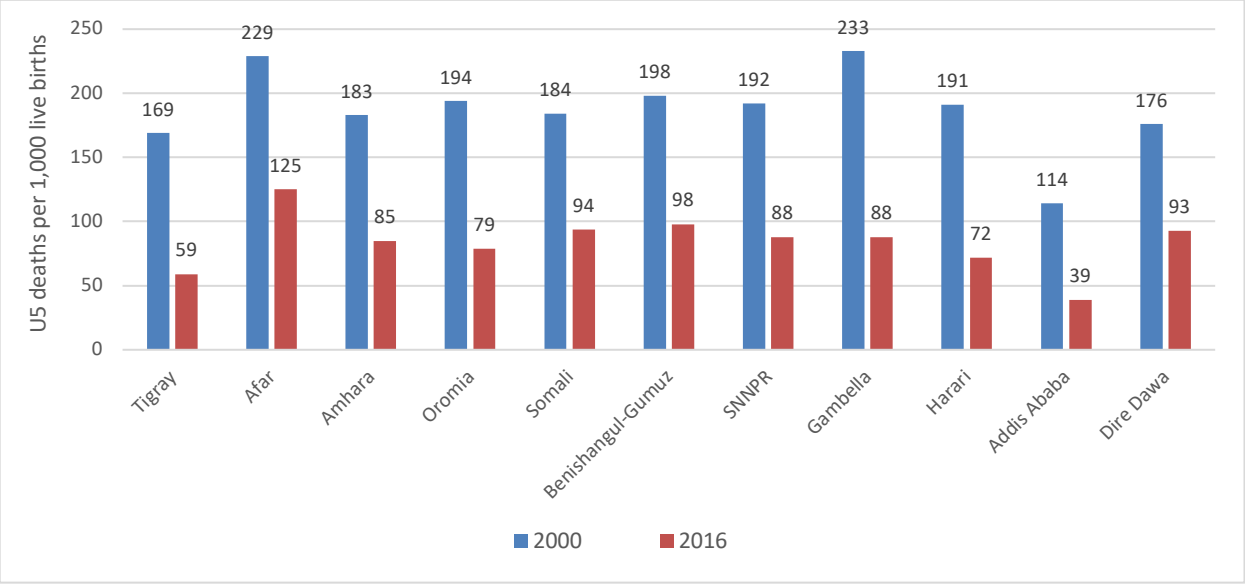


Figure 30: Under-5 Mortality in Ethiopia by Region/City Administration, 2000 and 2016 (Source: DHS)

5.12 Climate (barrier)

Throughout the study period, climate change was a barrier in Ethiopia's reduction in U5M, and likely contributed to the increase in wasting in children under 5 from 2000 (1.4% of children) to 2016 (2.9% of children), reported by the DHS.[2] With droughts and increasingly infrequent rainfall, this was particularly impactful in areas that rely on subsistence farming.[231] In 2015, Ethiopia experienced one of its worst reported droughts in decades, increasing the prevalence and risk of childhood malnutrition. Prevalence of wasting was 34% higher in areas affected by moderate drought compared to areas that did not experience drought, and nomadic pastoralist communities that rely on livestock for survival were especially impacted.[231] Regional rates of severe wasting were as high as 4.2% in Dire Dawa.

5.13 Low Utilization of Health Services (barrier)

Health service utilization in Ethiopia has been traditionally low. The Government of Ethiopia used many strategies such as establishment of new health facilities, creation of the HEP, deployment of ambulances for deliveries and emergencies, and removal of user fees for many services to improve access to health services across the country. However, despite this work to increase access, utilization of these services remains low. Over the period of 2005-2011, outpatient department attendance per capita fluctuated around only 0.3 visits per person per year.[2] As many interventions to decrease child mortality were delivered through health facilities, this low utilization likely affected coverage of some interventions. For example, while ORS and zinc were introduced for treatment of diarrhea through IMCI and iCCM, the 2016 DHS found that advice or treatment was sought for less than half (44%) of children under 5 with diarrhea.[237] In addition, improved but still low rates of facility-based delivery may have contributed to low access to and coverage of key neonatal interventions such as neonatal resuscitation and NICUs, affecting progress in reducing neonatal mortality. Overall, though improving access to key interventions to reduce U5M is essential, increasing utilization of these services remains an area for improvement in Ethiopia.

5.14 Pastoralist Culture (barrier)

In addition to the inequity in access to health services that pastoral areas have, the pastoralist communities' nomadic culture may be another barrier to effective U5M reduction and EBI implementation. This is especially relevant in regions including Afar, where 90% of the population is pastoralists (26% of the total pastoral population in the country), which report some of the highest U5M rates in the country. Studies suggest that there is significant inequity in health service utilization in pastoral areas between nomadic and settled communities. In addition, cultural traditions that involve poor nutrition practices in pastoralist communities, especially for neonatal health, including feeding butter and other solid foods to infants and withholding colostrum may contribute to increased neonatal mortality in these areas.[2]

5.15 Women's Empowerment (facilitator and barrier)

Improvements in women's empowerment in Ethiopia contributed to the reduction of U5M, though not necessarily to the extent as it was in other Exemplar countries; there remain a number of barriers in women's empowerment. Ethiopia experienced an increase in the proportion of girls attending primary school, the literacy rate among women, and the percentage of women currently employed (rising from 32% in 2005 to 48% in 2016). In addition, the majority of women reported primary or joint control over their earnings in 2016, and there is a similar rate of home ownership among men and women.[2,238] There is a high rate of completion for those women who do complete secondary school, comparable between men and women in 2014 in access to secondary education (92% and 91% respectively).[21] Improvements were especially seen in rural areas. While rates are still lower in these regions compared to urban areas and other case study countries, female literacy rates increased in many hard-to-reach regions, however, those rates were still significantly lower than male literacy rates.

Barriers remain in girls' completion of primary school and access to secondary school, often due to family commitments, distance to school, economic barriers and threats to their personal security, and there continue to be gaps in literacy rates between men and women. There is significant disparity in these indicators between rural pastoralist regions and urban regions, though progress has been made in rural areas. For example, in 2016, female literacy rates were 12.4% in Somali, and 87.8% in Addis Ababa.[2] Only 4% of girls in the Somali region completed at least primary school, compared to 24% in Dire Dawa and 46% in Addis Ababa.[2]

An additional facilitator and barrier (due to inequities) related to women's empowerment that may have affected U5M is access to family planning. Demand for family planning among married women ages 15-49 increased over the study period, from 45% in 2000 to 58% in 2016. Met need for family planning likewise increased from 8% in 2000 to 36% in 2016. However, met need varied widely by region, from 1.5% in Somali to 56% in Addis Ababa. This overall improvement in met need led to significant increases in the proportion of women using contraception across Ethiopia. In the case study period, contraceptive use by women increased in rural areas such as Amhara (from 7.5% to 47.3%), while rates also increased in urban areas such as Addis Ababa from 45.2% to 55.9%.[1,2]

5.16 Poverty Reduction Efforts (facilitator)

In addition to efforts to improve health, Ethiopia also implemented policies and large-scale programs reduce poverty in the country, aiding progress in U5M reduction. Beginning in 2000, the Government of Ethiopia launched three consecutive plans that aimed to reduce poverty – the Sustainable Development and Poverty Reduction Programme, the Plan for Accelerated and Sustained Development to End Poverty, and the Growth and Transformation Plan. These plans included multisectoral goals in areas such as health, infrastructure, agriculture, and education to achieve MDGs.[236]

In addition, the government has implemented a social protection program called the Productive Safety Net Programme since 2005. This program targets chronically food-insecure woredas in six regions of the country (Afar, Amhara, Oromia, SNNP, Somali, and Tigray). Participating households receive cash or food payments in exchange for work building infrastructure or protecting the environment. Further, poor households with limited labor capacity receive payments without requirements for labor. Program assessments have shown that the program's benefits include improved food security, likely contributing to improved nutritional status of children under 5 and subsequently reduced vulnerability to major CODs.[239,240]

5.17 Nutrition Programming (facilitator)

While there remain challenges in wasting due to contextual factors such as climate and conflict, Ethiopia stands out as a country that made major commitments to improving nutrition with a holistic, multisectoral approach, which contributed to the U5M reduction. In 2008, Ethiopia developed a National Nutrition Strategy, and then a National Nutrition Plan in 2013, both of which addressed the top three nutrition priorities in the country: food insecurity, undernutrition and malnutrition, and severe micronutrient deficiencies (especially iron, iodine, and Vitamin A).[241] The country also focused on building human capacity, with in-service and pre-service capacity building on nutrition education for health workers and program managers, HEWs, agriculture extension workers, and teachers. Nutrition activities through the health sector were integrated into the HEP and included Vitamin A supplementation and deworming, community management of acute malnutrition, salt iodization (and promotion of its use at the household level) and zinc supplementation. [241] Community management of acute malnutrition has been expanded to over 10,000 health posts, and community-based nutrition interventions have been scaled up to more than 500 woredas.[241]

As part of the multisectoral approach, the agriculture and education sectors were involved in implementation of many nutrition activities. The Ministry of Agriculture, through the Agriculture Extension Program, implemented activities including conducting nutrition trainings in the agriculture sector, strengthening Farmer Training Centers (FTC) to implement nutrition sensitive interventions, and mainstream interventions into national agriculture policies. The government also supported the development and adaptation of high nutritional value produce seeds from other countries. Within the education sector, through the National School Health and Nutrition Strategy, the government promoted nutrition activities at schools, including school gardening, micronutrient distribution, deworming tablets, improving water, sanitation and hygiene (WASH), and the promotion of iodized salt use at the household level.[241] Zinc supplementation was integrated into the HEPs iCCM.

Additionally, the government undertook initiatives to improve nutrition delivery for communicable and non-communicable diseases. Activities included integrating nutrition counseling and clinical nutrition services into HIV services, and developing and disseminating nutrition guidelines for HIV patients. These activities were scaled up to 400 health facilities.

There remained ongoing challenges and concerns related to the multisectoral implementation of nutrition strategies, including committed leadership, effective coordination across sectors, and sustained engagement across a wide variety of stakeholders. Ministerial-level intersectoral coordination has remained limited—especially at the regional level where they can be inadequate or non-existent.[241,242]

5.18 Water, Sanitation, and Hygiene (WASH) Improvement (facilitator)

Ethiopia's work to improve WASH has likely been a contributing contextual factor to reducing the incidence of diarrhea and, subsequently, U5M due to diarrhea. WASH policies and programs and community-level behavior change campaigns drastically reduced the national rate of open defecation in Ethiopia from 80% in 2000 to 27% in 2015.[232] Meanwhile, access to improved sources of drinking water increased, reaching 65% of households in the country in 2016 (though large differences between urban and rural areas persist).[2] Over the study period, incidence of diarrhea dropped in all regions and U5M due to diarrhea decreased by more than half from 424 deaths per 100,000 population in 2000 to 191 per 100,000 in 2016.[105] As care-seeking for diarrhea and coverage of ORS and zinc ultimately remained quite low over the study period, WASH efforts likely contributed to this reduction in disease burden and mortality.

6 Transferrable Knowledge for Other Countries

There were a number of replicable strategies from Ethiopia that would be relevant for other countries aiming to accelerate decline in U5M, learning from Ethiopia's successes and challenges. These include:

6.1 Develop and leverage a strong community health program

Key informants repeatedly noted the HEP, its HEWs, and other volunteers as crucial to Ethiopia's success in reducing U5M. Ethiopia's creation of a strong, widespread, and comprehensive community health program was particularly valuable in reducing U5M due to the country's large size and majority population living in rural and often hard-to-reach areas. HEWs played a role as key implementers of the majority of EBIs implemented in Ethiopia, likely increasing coverage compared to implementation at health facilities alone, by making health services more accessible to many communities that previously had low access to health services. In addition to providing services, the HEW and HDA's activities in the community sought to increase uptake of maternal and child health services through community education and engagement. Through these activities, the HEP was able to support implementation of facility-based interventions such as increasing institutional delivery.

Aside from establishing and leveraging a strong community health program, it is important to ensure that this program is properly supervised, monitored, and supplied to achieve optimal impact. Ethiopia's HEP notably featured a responsibility structure that ensured supervision and support was in place across levels of the program. For example, HEWs were supervised by staff of their local health centers. HEWs themselves trained and supervised HDA leaders who then oversaw "1 to 5" network structures within the HEP.

However, while leveraging community health program, it is important not to overburden CHWs. As noted in the *Introduction* section, many existing and new programs (both within and outside of the area of maternal and child health) were integrated into the HEW scope of work. Though this leveraging had many benefits as discussed above, key informants expressed concerns that overburdening HEWs could lead to burn out and turnover of this key cadre.

6.2 Integrate new initiatives by building on existing health system capacity rather than establishing new vertical programs and systems

Integration of new interventions into existing structures and previous initiatives rather than creating vertical programs was a valuable practice in Ethiopia for increasing feasibility of strong implementation and streamlining resources associated with introduction of many new interventions. In addition, interventions that were integrated into existing programs and structures likely had higher long-term sustainability than standalone ones. Notable examples of this strategy include:

- Integration of iCCM, ITN distribution, immunization, ANC, and post-partum visits into the existing HEP
- ORS and zinc implemented as part of FB-IMCI and iCCM rather than a standalone program
- Inclusion of new vaccines in routine immunization schedule
- Integration of PMTCT into ANC services

6.3 Use available evidence or identify need and develop locally relevant evidence to make evidence-based decision-making to determine need and appropriateness of EBIs; utilize implementation strategies based on global and local scientific evidence

Ethiopia typically explored globally emerging EBIs and used local, often already existing, research to determine appropriateness prior to implementation. For many EBIs, pilot testing was used to determine feasibility and inform national scale-up. However, Ethiopia recognized the importance of rapid introduction and scale-up – often without pilot testing – for EBIs that did not require significant context-specific adaptation, had a history of acceptability of similar EBIs, or had strong global evidence. For example, new vaccines were typically introduced rapidly, without pilot studies, and at a national scale.

6.4 Focus on ensuring high-quality delivery of care while improving access to health services

Throughout the study period, Ethiopia focused heavily on improving geographic and financial access to PHC. It successfully improved access, particularly in rural areas of the country, through health systems strengthening efforts such as establishing the HEP and integrating key EBIs into the program, establishment of new health facilities, training and deployment of additional health workers, and financial reforms removing user fees for MCH services.

However, quality of care remained a challenge in Ethiopia. Assessments identified fairly low quality of care for key EBIs such as FB-IMCI, iCCM, and ORS and zinc. Perceived low quality of care by the community likely impacted care-seeking and subsequent coverage of some EBIs like facility-based delivery, in spite of improved access. After recognizing quality gaps through evidence from assessments such as SPA and SARA, the FMOH established quality as an agenda item of the HSTP. As a result, its focus transitioned from increasing access to improving quality of care for the period of 2015 to 2020.

6.5 Engage and consult stakeholders, including donors, implementing partners, and professional bodies, and leverage their expertise early and often, ensuring they are coordinated and following the national vision and goals

The FMOH engaged local and international stakeholders early in the process of introducing new EBIs and continued to leverage expertise and resources of these groups throughout implementation. This involvement often began in the exploration and preparation phases, with local and international stakeholders participating in TWGs that often decided the appropriateness of an EBI and planned introduction. Many stakeholders also engaged as implementing partners. In addition to involvement of many international partners, the FMOH notably leveraged expertise of local academics and professional societies. For example, the Ethiopian Pediatric Society was a key contributor to adaptation of WHO's generic IMCI materials and developing and conducting training for NICUs.

6.6 Invest in health system strengthening to support EBI implementation based on identified gaps in infrastructure and staff

The FMOH built the infrastructure, including facilities, and increased HRs that provided the staff and space needed to effectively deliver EBIs at a large national scale. This HSS facilitated greater coverage and reach of EBIs across the large country, though equity issues still remained (see *5.11 Geography and Inequity of Coverage Across Regions*).

7 Conclusions

Ethiopia has achieved remarkable drops in U5M and progress in reduction of neonatal mortality. Increase in coverage of EBIs has been variable for some groups of the population based on geographic area and wealth. Health systems strengthening, leveraging and coordination of donor and partner resources, investment, a strong community health system, and data use were identified as some of the facilitators of this progress. In addition, improvements outside of the health system and a strong commitment to other initiatives such as WASH, women's empowerment and reproductive rights, and poverty reduction, were identified as key factors influencing U5M. However, challenges such as inequities of coverage, HRH, poor data quality, and dependence on donor funding remain as areas for future improvement in Ethiopia.

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APPENDIX A

EXEMPLARS IN UNDER-5 MORTALITY METHODOLOGY AND FRAMEWORK

The University of Global Health Equity is working with the team at Gates Ventures to explore approaches to better understand the successes of countries in reducing under-5 mortality (U5M). This work is initially designed with two aims: 1. Developing and testing an implementation framework and mixed methods approach to understand the success of these countries, and 2. Extracting actionable knowledge focused on implementation strategies and key contextual factors to inform other countries working towards the same goal. The scope of mortality was limited to amenable CODs – those which are potentially preventable with a stronger and higher quality health care system. The work was divided into a number of activities. These included: 1. identifying EBIs in use in LMICs; and 2. understanding how the EBIs implemented by a country were able to achieve success beyond their regional neighbors and other comparable countries. The analysis and conclusions were designed to be data-driven and rigorous, but also to create knowledge that is transferable and accessible and has the potential to be used across a range of key stakeholders. Therefore, the content developed by the Exemplars Project is intended primarily for an audience of national policymakers, implementers, and funders – people with the potential to significantly impact global health policy and implementation at scale. **The work was guided by the development of a framework which was informed by a number of existing frameworks in use for U5M (including Countdown 2015, WHO) and from existing implementation science frameworks** (see below).

Identifying evidence-based interventions to reduce U5M in LMICs

The initial work included identifying EBIs found to directly reduce U5M, dividing the work between those targeting the neonatal period (birth to 28 days) and the infant and child period (28 days to 4 years). This work included literature review, discussions with experts in the area, and revisions with them as the work progressed. We focused on those interventions that were relevant to resource-constrained settings, those that were directly related to preventing potential life-threatening conditions (such as vaccinations, safe birth practices, and ITNs), and those treating illness or other complications (such as antibiotics, antimalarial medication, and neonatal resuscitation). We included interventions that were at the individual process level (administering the right antibiotic at the right time) as well as those targeting inputs (development of neonatal intensive care units) and systems needed to deliver the EBIs meeting the definitions of quality including effectiveness, safety, timeliness, and equity (such as CHWs). For neonatal mortality we also expanded to a limited set of prenatal and intrapartum interventions proven to reduce neonatal death. We did not focus on those interventions that resulted in reductions in stillbirths, as those are not included in the assessment of U5M rates. This was driven in part by the changing epidemiology of neonatal CODs seen in some countries, with LBW and prematurity increasing in importance in causes of mortality.[243]

Table 69: Infant and Child Under-5 Mortality Evidence-Based Interventions

Cause of Death	EBI	
Lower respiratory infections	Antibiotic treatment	
	Vaccination: PCV	
	Vaccination: Hib	
	Community-based management	
	Facility-based management	
Diarrheal diseases	Oral rehydration therapy	
	Zinc supplementation	
	Vaccination: Rotavirus	
	Community-based management	
	Facility-based management	
Malaria	Antimalarial combination therapy	
	Rapid diagnostic testing	
	Insecticide-treated nets	
	Indoor residual spray	
	Intermittent preventative therapy for high-risk groups	
	Community-based management	
	Facility-based management	
Measles	Vaccination: Measles	
	Vitamin A supplementation (prior to vaccination)	
Malnutrition	Exclusive breastfeeding for six months	
	Continued breastfeeding and complementary feeding after six months	
	Vitamin A supplementation	
	Management of severe acute malnutrition (ready-to-use food, rehydration, antibiotics)	
HIV	ARV treatment for infants and children	
	HIV testing of children born to HIV+ mothers	
	Prevention of mother-to-child transmission	Early diagnosis of pregnant women (or pre-pregnancy)
		PMTCT treatment for mothers* and post-partum to exposed infants
		Elective Caesarean section for untreated HIV+ mothers**; replacement feeding**
		ARV treatment for mother for life as prevention (started in 2012)
		Exclusive breast feeding
Meningitis	Vaccination: PCV meningococcal	
	Vaccination: Hib	
	Vaccination: Meningococcal	
	Antibiotic treatment	
	Chemoprophylaxis during acute outbreaks	
Other vaccine preventable diseases	Vaccination: Tetanus	
	Vaccination: Diphtheria	
	Vaccination: Pertussis	
	Vaccination: Polio	

* No longer recommended (PMTCT versus ART for life)
** No longer recommended for women on ART with suppressed viral load

Table 70: Neonatal Mortality Evidence-Based Interventions

Period of Risk	EBI	
Preconception	Folic acid supplementation	
Antenatal	Tetanus vaccination	
	Malaria prevention and treatment	Intermittent presumptive treatment
		ITNs
	Iodine supplementation (in endemic iodine deficient settings)	
	4 or more antenatal visits (ANC4)	
	Prevention and treatment of preeclampsia and eclampsia	Calcium supplementation*
		Low-dose aspirin for high-risk women*
		Antihypertensive treatment for severe hypertension
		Magnesium sulfate
		Early delivery
Intrapartum	Antibiotics for PPROM	
	Corticosteroids for preterm labor	
	Caesarean section for breech or obstructed labor	
	Active management of delivery (including partograph)	
	Clean delivery practices (incl. clean cord-cutting)	
	Trained birth attendant	
	Facility-based delivery	
	Basic emergency obstetric and newborn care (BEmONC)	
	Comprehensive emergency obstetric and newborn care (CEmONC)	
	Timely transport for higher level care for mother	
Postnatal	Newborn resuscitation	
	Immediate breastfeeding	
	Prevention and management of hypothermia	Immediate drying and wrapping
		Delayed bathing
		Skin-to-skin
		Baby warming
	Kangaroo care for LBW/prematurity	
	Timely transport for higher level care for mother	
	Post-partum visits to identify danger signs and provide active referral	
	Antibiotics for suspected or confirmed infection	
	Surfactant therapy for respiratory distress syndrome and prematurity	
	Neonatal intensive care units (equipped, trained staff, standards and protocols established and followed)	

* Further assessment needed in literature review

Both the desk review and the primary research are informed by an implementation science framework that incorporates a number of existing frameworks and is designed specifically for this project. While we are often able to identify policies and EBIs chosen by a country to reduce U5M, the key lessons in how these were chosen, adapted, implemented, and sustained are often missing from available published or gray literature. Because the same policies and interventions brought different results in different countries, implementation science offers important tools for analyzing and understanding how to think more holistically about how and why countries were able to reduce U5M and from where lessons in replication can be drawn. To guide the overall work, we developed a framework to understand the contribution of contextual factors and the different levels of actors involved: global, national, ministry, subnational, facility, and community.

We reviewed existing implementation science frameworks and have combined a number of commonly applied ones as well as insights from work underway by Dr. Binagwaho to guide how we interpret existing evidence and to design tools for primary research.

The primary frameworks and implementation science resources we drew from include:

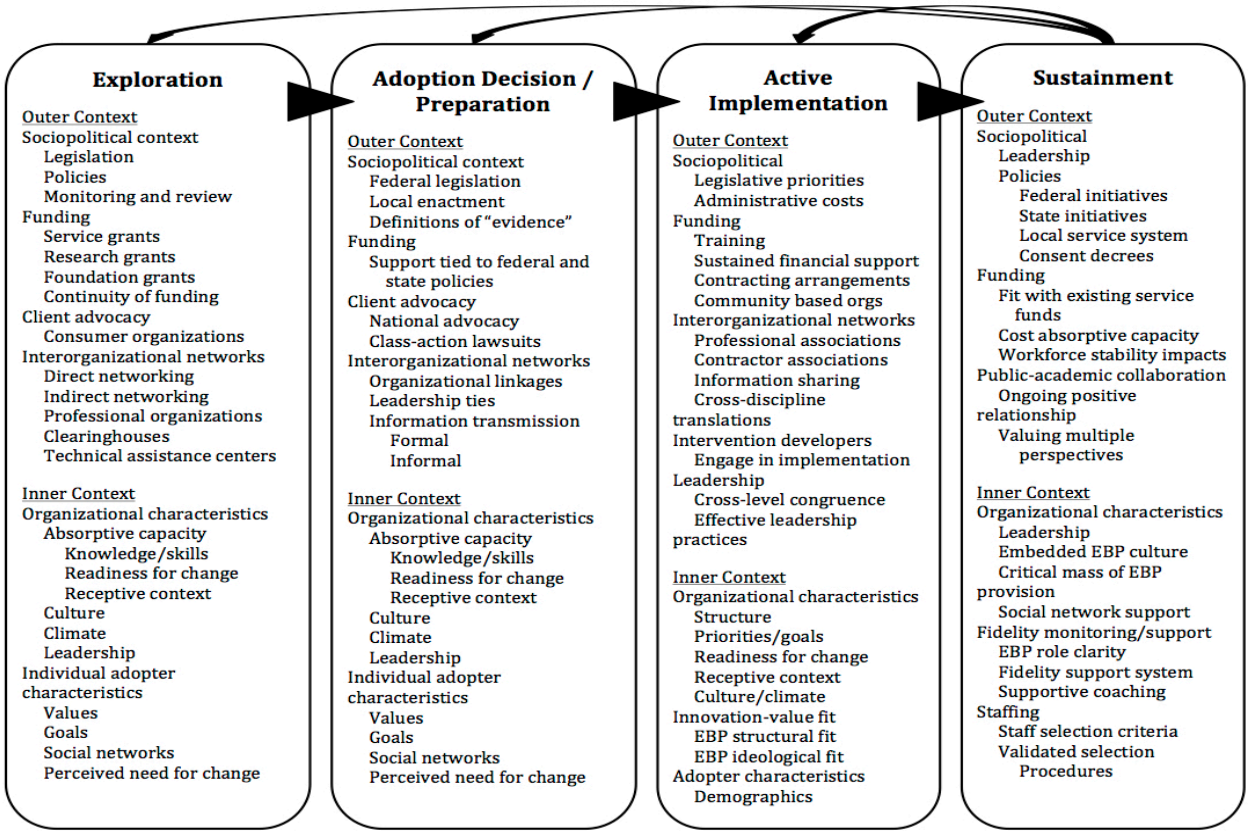

Figure 31: EPIS model of implementation (Source: Aarons, et al)

1. **Exploration, Preparation, Implementation, and Sustainment (EPIS)**[244]: This framework walks through four key steps of the implementation process needed to achieve long-term change-starting. Within each phase there are important contextual factors which may influence success (Figure 33).

2. **Re-AIM**[245]**:** This evaluation framework breaks down implementation outcomes into Reach (coverage), Effectiveness, Adoption (range and proportion of individuals and organizations willing to participate), Implementation (fidelity, time, cost, and adaptations made) and Maintenance (institutionalization into routine care and policies, and long-term impact). It is designed to better understand the range of factors that influence success or failure at the individual and broader levels.

3. **Consolidated Framework for Implementation Research (CFIR)**[246]**:** This framework serves as a guide to understand the contextual factors that influenced the success or failure of implementation of a specific intervention. These include the outer context, the inner (organizational) context, the characteristics of the intervention, the implementation approach, and the individual actors responsible for implementation.

4. **Implementation Outcomes (Proctor et al)**[247] **:** This approach distinguishes implementation outcomes from the more traditionally measured intervention and system outcomes. It identifies and defines key areas that are critical to achieving overall effectiveness, core goals of initiatives targeting U5 mortality. Outcomes include acceptability, adoption, appropriateness, costs, fidelity, feasibility, penetration (reach), and sustainability (Figure 34).

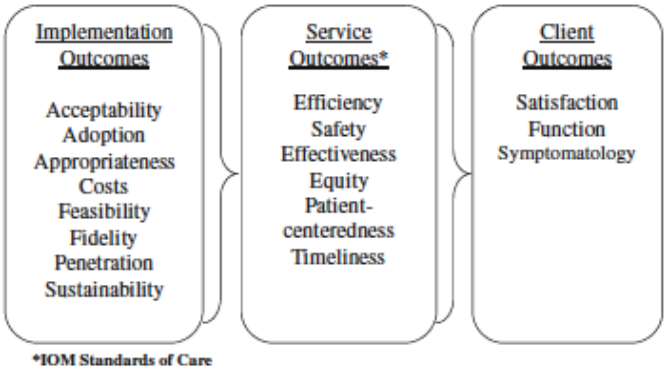

Figure 32: Types of outcomes in implementation research (Source: Proctor, et al)

5. **The implementation principles for managing all levels of a health sector as described in the book in progress by Dr. Binagwaho:** This book is written to share her experiences on what was successful, what failed, why, and how, when she served in technical and political positions in the health sector in Rwanda between 1996 and 2016.

None of the frameworks alone were felt to cover the complexity the implementation strategies and steps undertaken at the national, subnational, and care-delivery levels. By combining them we have developed a framework that will be used to guide how we prioritize areas for primary research, interpret the secondary research, and form the themes for synthesis of the entirety of our work (Figure 34).

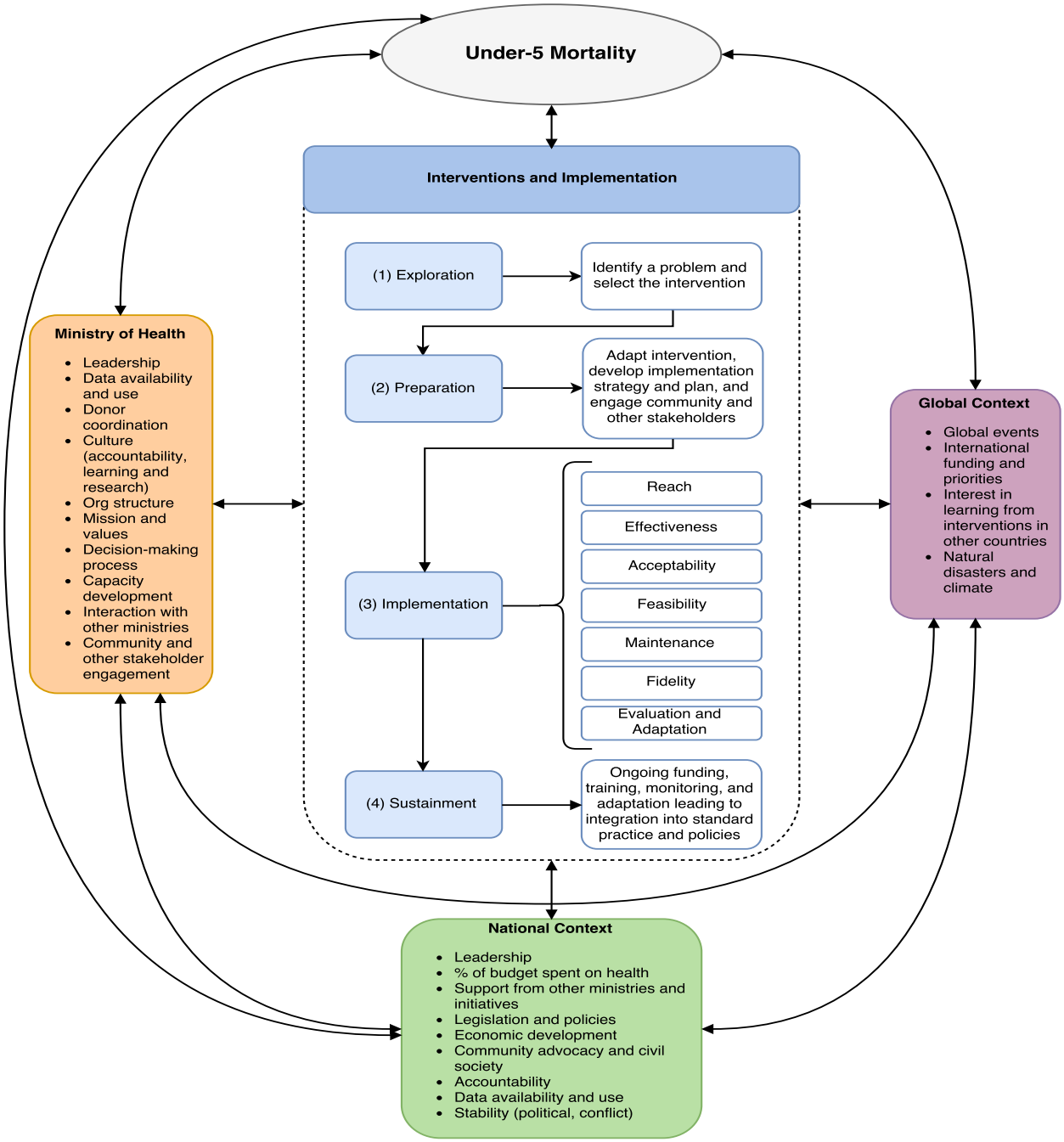

Figure 33: Framework for understanding interventions to reduce under-5 mortality (copyright UGHE)

Desk Review (Led by the Strategic Analysis, Research, and Training (START) Center at the University of Washington with in-depth support from UGHE team and Gates Ventures)

The team undertook an extensive review of available information and published data on the rates and progress of U5M, policies, strategies, specific EBIs available to potential exemplar countries, and the uptake and implementation of these EBIs in five exemplar countries defined as countries which have reduced U5M beyond expectations based on regional or resource comparators. Initial secondary research was performed through MEDLINE (PubMed) and Google Scholar, using the search terms "child mortality" or "under-5 mortality" and the country's name. Further searches included specific EBIs, CODs, or contextual factors as search terms (e.g. "insecticide-treated nets," "malaria," or "community health workers"). Initial desk research was synthesized and then reviewed by the UGHE team for accuracy and completeness. The desk review is an iterative process, with ongoing additions occurring throughout the primary research process. As noted, the initial review was limited to CODs felt to be "amenable" with effective interventions and targeted all U5M, from neonatal through infancy and early childhood. While maternal health is a critical determinant of child survival, given the extensive work already underway and the limited resources and time of the contract, we did not include an exhaustive review of these EBIs but focused on those more directly related to the childbirth period or primary data analysis. This will be supplemented by selected maternal interventions. We purposely did not include in-depth reviews of important broad interventions that contributed to U5M reduction including education, poverty reduction, water and sanitation, and programs designed to improve nutritional status. These will be captured as important contextual factors in the country case studies.

Primary Research (Led by UGHE team and MERQ Consultancy)

In collaboration with our in-country partners, MERQ Consultancy, we identified KIs reflecting a broad range of experience and viewpoints. KIs were chosen based on the topics identified in the desk review and through other analyses in close collaboration with the in-country partner, prioritizing KIs able to provide information on the Exploration, Preparation, Implementation, Adaptation and Sustainment (EPIAS) stages during the period of study. KIs included current and former FMOH employees responsible for high-level strategic direction of the ministry or specific disease or intervention areas; implementing partners; and other multilateral organizations or donor organizations who had managed partner-supported or partner-led activities. Some informants represented more than one area or role based on their experience over the 15 years and were interviewed for each of their multiple viewpoints. We prioritized individuals active in the study period but were able to also capture some experiences from before 2000 and after 2015.

Informed by the framework and review of relevant literature on contextual factors and implementation outcomes, we developed core interview guides for four main routes of inquiry.

1. Global and national level actors;
2. Federal Ministry of Health (FMOH) actors;
3. Project managers and implementers for specific CODs or EBIs; and
4. Other partners

The interviews were designed to address the EBI implementation process, from exploration to preparation, implementation, adaptation, and sustainment. This included critical contextual factors at the relevant global, national, ministry, and local levels. The interviews also identified additional sources of data and information which could be added to the knowledge base and understanding already developed from the desk review. Interview guides were adapted from the core tools utilized by the Exemplars U5M project and interviews were conducted in English or Amharic depending on the linguistic comfort of the KIs.

All interviews were led by a UGHE Research Associate (Laura Drown) and/or the in-country lead (Dr. Alula Teklu). Following the close of the interviews, notes were combined and the tape recordings) were used to clarify areas as needed. Recorded interviews were translated as needed, transcribed and reviewed for quality and consistency by both MERQ Consultancy and UGHE teams.

Human Subjects Review

The work was approved by the RRC and the St. Paul's Hospital Millennium Medical College in Ethiopia. The ethics review committees of UGHE and Northwestern University also exempted the study. No quotes or specific viewpoints were included which were identifiable to the source without explicit permission. All recordings and interviews had names removed and were kept in password protected computers and stored on a limited access Google Drive. All recordings were destroyed once the interview coding had been completed.

KIs were informed about the goals and structure of the project, and consent for participation and recording was obtained separately from the interview.

Analysis and Synthesis

The UGHE team used a mixed methods explanatory approach, applying the framework to understand the progress (or lack thereof) for each COD and coverage of chosen EBIs, as well as facilitators and barriers at the local, national, and global levels. This approach was designed to understand what, how and why the Federal Government of Ethiopia was able to achieve success in decreasing U5M and what the challenges were. The analyses were also informed by work completed by other initiatives, including Countdown 2015, equity plots from the International Center for Equity in Health (Victora and team), and geospatial mapping from the Institute for Health Metrics and Evaluation (Simon Hays and team), amongst others.

KI interviews were coded by one of the researchers using the framework developed for the overall U5M Exemplar Project, to extract the EPIAS steps, implementation strategies, implementation outcomes and contextual factors. As emerging themes were identified, a priori codes for contextual factors and strategies were adapted and expanded.

Final Products

The work done by UGHE and Gates Ventures will result in new knowledge examining the implementation strategies for developing needed policies and identifying, adapting, and scaling EBIs, supporting and obstructing contextual factors from countries successful in reducing U5M using an implementation science approach. The final products will include (1) the generally-applicable implementation science framework shown here, (2) in-depth case studies of four exemplar countries using primary and secondary research, (3) case studies of three exemplar countries based on desk research and buttressed with light-touch primary research, and (4) a cross-country synthesis of insights from all seven exemplar countries. Although all countries deserve deeper research on and analysis of their successes in U5M reduction, limitations in resources and time bound the scope of this project. The work done related to these seven exemplar countries will serve as a proof of principle of the added value of applying implementation science to the research of U5M interventions and successes. The products from this work will be disseminated through a larger online platform created by Gates Ventures to highlight actionable lessons from exemplar countries on a variety of health topics.