Exemplars in Under-5 Mortality: Rwanda Case Study

Dr. Lisa R Hirschhorn[1,2], Dr. Felix Sayinzoga[3], Caroline Beyer[1,4], Kateri Donahoe[1], Dr. Agnes Binagwaho[1]

[1] University of Global Health Equity
[2] Feinberg School of Medicine, Northwestern University
[3] Maternal, Child, and Community Health Division, Rwanda Biomedical Center
[4] Icahn School of Medicine at Mount Sinai

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Abbreviations

ABC	All Babies Count
ACT	Artemisinin-based combination therapy
AfDF	African Development Fund
AIDS	Acquired immune deficiency syndrome
AMSTL	Active management of the third stage of labor
ANC	Antenatal care
AQ+SP	Amodiaquine and sulphadoxine-pyrimethrine
ART	Antiretroviral therapy
ARV	Antiretroviral
ASM	Agent santé maternelle
BCG	Bacillus Calmette–Guérin
CAGR	Compound annual growth rate
CBHI	Community-based health insurance
CBNP	Community based nutrition program
CCI	Composite coverage index
CHUK	Centre Hospitalier Universitaire de Kigali
CHW	Community health worker
COD	Cause of death
CPAF	Common Performance Assessment Framework
DH	District hospital
DHS	Demographic and Health Survey
DPAF	Donors Performance Assessment Framework
DTP	Diphtheria-tetanus-pertussis
EAC	East African Community
EBI	Evidence-based intervention
EID	Early infant diagnosis (of HIV)
EmONC	Emergency obstetric and neonatal care
EPI	Expanded Program on Immunization
FBD	Facility based delivery
FDI	Foreign direct investment
GBD	Global Burden of Disease
GDP	Gross domestic product
GFATM	The Global Fund to Fight AIDS, Tuberculosis and Malaria
GSMM	General Senior Management Meeting
HBMF	Home-based management of fever
HC	Health center
HIPC	Heavily Indebted Poor Country
HIV	Human immunodeficiency virus
HMIS	Health Management Information System
HPV	Human papillomavirus
HW	Health worker
iCCM	Integrated Community Case Management
ICT	Information and communications technology
ICU	Intensive care unit
IHME	Institute for Health Metrics and Evaluation
IMB	Inshuti Mu Buzima (Partners In Health Rwanda)

IMCI	Integrated Management of Childhood Illness
IMF	International Monetary Fund
IPTp	Intermittent preventive treatment in pregnancy
IRS	Indoor residual spraying
ITN	Insecticide treated (mosquito) net
JHSR	Joint Health Sector Review
KI	Key informant
KMC	Kangaroo mother care
LIC	Low income country
LMIC	Low and middle income country
M&E	Monitoring and evaluation
MCH	Maternal and child health
MDG	Millennium Development Goal
MINECOFIN	Ministry of Finance and Economic Planning
MMR	Maternal mortality rate
MNCH	Maternal, neonatal, and child health
MOH	Ministry of Health
MR	Measles-rubella
MTCT	Mother-to-child transmission (of HIV)
MUAC	Mid-upper arm circumference
NGO	Non-governmental organization
NMR	Neonatal mortality rate
ORS	Oral rehydration solution
P4P	Pay for performance
PBF	Performance based financing
PCV	Pneumococcal conjugate vaccine
PEPFAR	President's Emergency Plan for AIDS Relief
PHC	Primary health care
PHCPI	Primary Health Care Performance Initiative
PI	Principal investigator
PMTCT	Prevention of mother-to-child transmission
PPP	Public-private partnership
QI	Quality improvement
RBC	Rwanda Biomedical Center
RDT	Rapid diagnostic testing
SDG	Sustainable Development Goal
SMM	Senior Management Meeting
SMS	Short message service
TRAC	Treatment and Research on AIDS Center
TWG	Technical working group
U5M	Under-5 mortality
U5MR	Under-5 mortality rate
UGHE	University of Global Health Equity
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations International Children's Emergency Fund
USD	United States dollar
WHO	World Health Organization

1 Executive Summary

1.1 Background

1.1.1 Exemplars in Global Health Under-5 Mortality Project

The Exemplars in Global Health project aims to identify lessons from countries' successes in global health to inform the decision-making of leaders, policymakers and funders. The University of Global Health Equity and bgC3 are collaborating to understand exemplar countries successful in reducing under-5 mortality (U5M) – a high priority issue within global health. The project is designed to identify and disseminate cross-cutting implementation strategies and policy lessons that can be adapted and adopted in other countries working to achieve similar progress. The scope is limited to deaths amenable to improvement in healthcare delivery and quality, including uptake of evidence-based interventions (EBIs). The project developed a novel implementation science-based approach, used to understand EBI implementation strategies and outcomes, and to identify key contextual factors and policies that facilitated or hampered this success. Selected existing implementation science frameworks and lessons learned from Dr. Agnes Binagwaho, the co-lead, during her tenure in the Rwanda health system were synthesized to create an implementation science framework to guide the research and analysis. This framework will allow us to elucidate, analyze and compare successes and challenges in multiple exemplar countries.

1.1.2 Rwanda

Rwanda suffered a devastating war and genocide in 1994 that took approximately one million lives, destroyed the public health infrastructure, and rendered it one of the poorest countries in the world. In the ensuing decades, Rwanda has achieved an extraordinary recovery, characterized by sustained economic growth, declines in extreme poverty and income inequality, and substantial public health gains. Notable among these are data from the DHS's, which documented an U5M rate that dropped by 74 percent, from 196 per 1,000 live births in 2000 DHS to 50 per 1,000 live births in 2015.[1,2] This reduction in U5M greatly exceeded expectations based on gross domestic product (GDP) growth and U5M reduction rates regionally and globally. The reduction in neonatal mortality was less dramatic. Gains were still seen, with a decline of 55 percent over 15 years, from 44 per 1,000 live births in 2000 to 20 per 1,000 live births in 2015.[1,2] This was faster than sub-Saharan Africa, which had a decline in neonatal mortality of 31 percent (from 41 in 2000 to 28 in 2015), and low-income countries, which had a decline of 35 percent (from 42 in 2000 to 26 in 2015).[3]

1.1.3 Methods

The bgC3 and UGHE teams performed a review of published and gray literature related to U5M in Rwanda and the EBIs implemented to reduce U5M. The UGHE team then conducted and analyzed 16 key informant interviews with policy-makers, implementers at the national and subnational level, and partners in Rwanda, to understand the implementation strategies, policies, and contextual factors most relevant to the success in reducing U5M in Rwanda and extract potential lessons learned and approaches that could be implemented in other countries. Additional analyses from the International Center for Equity in Health (Victora et al) and geospatial mapping from the Institute for Health Metrics and Evaluation (Hays et al) were used to understand changes in equity indices for mortality and EBI coverage.

1.2 Key Findings

1.2.1 Coverage of Selected U5M Interventions Based on Data Available from the DHS

Table 1: Coverage of Selected U5M Evidence-Based Interventions in Rwanda (Source: Rwanda DHS 2000, 2005, 2010, and 2014-15 and DHS STATcompiler)

U5 Cause of Death	Intervention	2000	2005	2010	2014
Lower Respiratory Infections	Care-seeking for pneumonia	15.5%	27.9%	50.2%	53.9%
	Vaccination: 3 doses of PCV				94.7%
	Vaccination: Hib			92.9%	98.2%
Diarrheal Diseases	Oral rehydration therapy	20.2%	29%	36.6%	34.7%
	Vaccination: 3 doses of rotavirus				94.7%
	Care-seeking for diarrhea	15%	14.4%	41%	45%
Malaria	Insecticide-treated nets		12.6%	69.6%	67.7%
	Care-seeking for fever	8.7%	31.3%	44.8%	50.1%
	Treatment of children with fever by artemisinin-based combination therapy (ACT)			4.0%	11.2%
	Prompt treatment of children with fever by ACT			2.6%	7.4%
Measles	Vaccination: Measles	86.9%	85.6%	95.0%	95.2%
HIV	HIV counseling during antenatal care		55.8%	90.6%	93.0%
	HIV testing during antenatal care		21.5%	94.5%	97.9%
Other vaccine preventable diseases	Full vaccination coverage with 3 doses DPT, 3 doses polio, measles and BCG	76.2%	75.5%	90.3%	92.7%
Neonatal Causes of Death	Antenatal care: 1+ visits by a skilled provider	92.5%	94.4%	98.0%	99.1%
	Antenatal care: 4+ visits by a skilled provider	10.4%	13.3%	35.4%	43.9%
	Antenatal care: 1st antenatal visit in the 1st trimester	4.7%	7.9%	38.2%	56.1%
	Vaccination: 1+ doses of tetanus toxoid during pregnancy	64.8%	63.4%	76.5%	79.6%
	Delivery in a health facility	26.5%	28.2%	68.9%	90.7%
	Delivery attended by skilled provider	26.7%	28.4%	69.0%	90.7%
	Delivery by C-section	2.1%	2.9%	7.1%	13.0%
	Postnatal care: Postnatal visit for baby within 2 days of birth	2.9%	3.7%	4.7%	19.3%
	Postnatal care: Postnatal visit for mother within 2 days of birth			17.6%	43.0%

Details on equity of coverage for these EBIs are included in the report.

1.2.2 Evidence-Based Interventions to Address Major Causes of Death

Throughout the period of interest (2000-2015), major causes of death included lower respiratory infections, malaria, diarrheal disease, and neonatal causes of death. Mortality rates for each of these causes of death decreased over this time period. Significantly, child and infant causes of death decreased at a faster rate than neonatal causes of death.

Table 2: Number of U5 Deaths per 1000 Live Births by Cause in Rwanda (Source: IHME, GBD Compare)

Number of U5 Deaths per 1,000 Live Births					
	1995	**2000**	**2005**	**2010**	**2015**
LRI	32.4	29.0	21.7	12.6	9.6
Measles	23.8	11.1	0.6	0.6	0.1
Malaria	21.1	21.4	5.1	3.8	3.9
Diarrheal diseases	20.5	16.5	16.9	8.1	4.2
Protein-energy malnutrition	13.6	12.6	10.1	5.7	4.4
Tuberculosis	5.7	3.8	1.9	0.9	0.7
Meningitis	5.6	5.2	4.4	2.9	2.5
HIV/AIDS	5.5	6.0	3.6	1.6	0.2
Total neonatal	26.9	28.1	24.3	18.6	16.3
Other	29.9	22.4	17.4	11.8	9.6
TOTAL	**185.0**	**156.2**	**105.9**	**66.7**	**51.5**

1.2.2.1   General Implementation Strategy

Over time Rwanda developed a comprehensive strategy for implementation of EBIs to address child mortality. This strategy followed a number of key steps, modelled after the implementation science framework of exploration, preparation, implementation, and sustainment from Aarons, et al.[4] The Rwandan process progresses from decision-making through policy and protocol development, community engagement and initial testing, finally to rapid scale, adaptation, and sustainability. These steps are detailed in Appendix B and summarized below.

- **Step One: Exploration using data, research, and evidence –** This step includes the identification of a need, its impact, and key stakeholders. Based on review of published evidence and global guidelines and the input of stakeholders and partners, Rwanda identifies the interventions that could address this need.
- **Step Two: Preparation using evidence –** Choice of intervention depends upon a variety of factors including need, impact, feasibility, and acceptability. Further preparation includes clear budgets, resource assessments, national and local strategy documents, and monitoring and evaluation frameworks. Rwanda then tests locally for feasibility and acceptability, but with plans for national scale and sustainability prior to beginning.
- **Step Three: Initial implementation nationally –** With the dissemination of national strategy documents and the training of personnel using national guidelines, Rwanda implements one vision using multiple implementers. Implementation success also depends on continued stakeholder engagement, ongoing monitoring for possible improvements, and accountability processes.
- **Step Four: Sustainment through adaptation, monitoring, and integration –** Data-driven adaptation of interventions for continuous improvement depends on regular M&E reviews and ongoing research to identify better interventions with preparation to adapt, add, or replace the existing intervention. The intervention is also integrated into "business as usual" through ensuring funding and integrating training or capacity-building into pre-service education.

Rwanda was found to have implemented almost all of the EBIs identified as effective in reducing U5M in low and middle-income countries (see Appendix A), with varying coverage but high levels of equity. Neonatal mortality reduction was slower and implementing neonatal-specific EBIs is a more recent area of focus in Rwanda. Most EBIs followed the steps described above including determining the underlying causes of U5M in a specific cause of death; identifying potential interventions; preparing through stakeholder engagement and adaptation; determining funding needs and sources; strengthening needed systems and development of national policies and protocols to drive systematic adoption; and integration of data needs for monitoring and evaluation into routine information systems as much as possible. We describe this process for some example EBIs below with descriptions of each EBI in the full report.

1.2.2.2 Pneumococcal Vaccination

Rwanda explored the possibility of introducing pneumococcal vaccine (PCV) in 2007 due to a combination of data showing pneumonia was the leading cause of death for children under-5 in Rwanda and the addition of the vaccine to the World Health Organization (WHO) recommended routine childhood immunizations list.[5,6] Following a feasibility study by the Ministry of Health (MOH), Rwanda became the first sub-Saharan country to introduce the vaccine.[7] In preparation, the MOH performed a nationwide cold chain evaluation and investment, a review of vaccine safety and efficacy profiles, and a financial capacity assessment.[7,8] Further preparation included cascade training of local sensitizers and vaccinators and a needs estimate performed by CHWs.[7] The MOH rolled out PCV nationwide within 5 months in 2009, with vaccination rates of 97 percent by 2010.[9] PCV has now been integrated into the standard pediatric vaccine schedule, and CHWs gather monthly monitoring and evaluation data to identify any areas with gaps in coverage.[7] The strategies used in the rollout of PCV were then adapted for the future introduction of other vaccines, including rotavirus and HPV.[7,8]

1.2.2.3 Insecticide-Treated Nets

Rwanda had multiple nationwide campaigns for mass distribution of insecticide-treated nets (ITNs) for vector control of malaria in the mid 2000s. The MOH combined this effort with existing nationwide campaigns (measles vaccination and national maternal and child health week), monitored need and adoption using the national census and data from local leaders, used CHWs to distribute ITNs and monitor proper use in homes, and changed national policy to prohibit the importation of untreated bed nets. With these strategies, over 9 million ITNs were distributed and the percent of children under-5 sleeping under mosquito nets increased from 16 percent in 2005 to 70 percent by 2010.[10,11] When the majority of districts started reporting increases in malaria prevalence in 2009, the MOH performed independent efficacy monitoring of ITNs, concluding that there was reduced efficacy after 18 months, instead of the certified three to five years. Using monthly HMIS data, the MOH has since strategically distributed ITNs to those areas most heavily affected by this unexpected gap in coverage.

1.2.2.4 Prevention of Mother-to-Child Transmission of HIV

In their implementation of prevention of mother-to-child-transmission (PMTCT) strategies, Rwanda relied heavily on data and published evidence, both in identification of PMTCT as an issue and adapting treatment policies. The MOH updated national guidelines every two years, based on the newest evidence and with the assistance of national and international partners, allowing for early adoption of improved treatments notably, adoption of Option B+ prior to international recommendations by WHO. The MOH also invested

heavily in primary care, health infrastructure and human resource capacity in order to equitably scale-up PMTCT using a decentralized model, resulting in availability in all health centers nationwide by 2009.[12] MTCT rates have dropped from 9.7 percent in 2006 to 1.8 percent in 2015.[13,14]

1.2.3 Cross-Cutting Contextual Factors

Through the desk review and key informant interviews, we identified a number of cross-cutting contextual factors at the global, national, and community levels that contributed to the successful implementation of EBIs and subsequent reduction in U5M. Some of these were specific policies that enabled the effective implementing of the EBIs, while others were larger cultural features, such as accountability and learning. These policies and other contextual factors created a health system and national and local environments that were critical to Rwanda's implementation of EBIs and reduction of U5M. These contextual factors broadly include:

1. **Culture and governance**, including the adoption of national strategy documents to set ambitious health goals, national leadership at the political and ministry levels, a financial commitment to health (see below), the creation of a culture of accountability at all levels of government, and the incorporation of civil society into health care systems
2. **Coordination, collaboration and communication** within the health sector; across ministries; and between government bodies, donors and implementing partners
3. **Health system design** focusing on primary health care, an early commitment to decentralization, and development of a robust community health program
4. **Financial policies and protection**, including government spending on health, coordination of donor funds, and development of community-based health insurance to ensure financial access to care
5. **Systems of learning and improvement**, such as building the health information system, using data for decision-making, continuous program innovation, and rapid translation of research and new global guidelines into practice
6. **Prioritization of primary care** with early integration of disease-specific programs and leveraging of funds to support larger district and national health systems
7. **Designing for scale and sustainability** by investing in primary care health infrastructure, geographic access to health centers, and human resources; and by rapidly incorporating specific EBIs into national policies, developing national protocols and trainings, and rapid scale-up of interventions nationally
8. **Focus on equity**, reflected in the attention to access, rapid scale-up to reach even the most vulnerable, and coordination between the Ministry of Health and other ministries including the Ministries of Gender, of Youth, and of Local Government

Specific examples of and details on potential lessons for implementation strategies in other countries are included in more detail in the report.

1.2.4 Challenges

1.2.4.1 Neonatal Mortality

Although Rwanda reduced U5M by markedly more than their regional and global counterparts between 2000 and 2015, they did not achieve the same level of reductions in neonatal mortality (although still greater than the region). According to co-author and former Minister of Health, Dr. Binagwaho, neonatal mortality became a national priority only when the 2010 Global Burden of Disease report "put a number behind a situation we intuitively felt." Despite increases in facility-based delivery and antenatal care, neonatal mortality rates were decreasing more slowly than infant and child mortality rates.[15] Since that time, the MOH has started neonatal death audits of all cases of neonatal mortality in order to better understand where interventions are needed. Using these data, review of existing evidence, and the input from the neonatal mortality technical working group, the MOH has adopted a number of maternal and neonatal health interventions, including skin-to-skin and immediate warming, kangaroo mother care for low birth weight and premature infants, Helping Babies Breathe, active management of the third stage of labor, emergency obstetric and newborn care (EmONC), and neonatal intensive care with incubators.[16,17] While there has been success in implementing a number of these EBIs, the country continues working to reduce neonatal morality, exploring and adopting new interventions supported by data, and sustaining those interventions that have shown success.

Other challenges include responding to ongoing emerging outbreaks related to influx of refugees, some increases in malaria, and increasing coverage of some of the EBIs, as noted in Table 1. These are covered fully in the report.

1.2.5 Transferrable Knowledge for Other Countries

We asked each key informant about what they thought could be taken from their experiences in Rwanda and replicated in other countries. Although there are factors intrinsic to Rwanda that contributed to their success in reducing U5M (e.g. small size, post-genocide peace, strong stable national leadership), the key informants identified a number of implementation strategies, many of which need both leadership at the national levels, including ministries, as well as local ownership.

- Ensure accountability at all levels
- Build capacity of your implementers and policymakers in the ministry and locally
- Appoint policymakers based on ability, and hold them accountable to the people they are serving
- Change the culture of data use to include training, increased data use and quality, and linkage to accountability systems
- Support leadership at all levels
- Create laws, policies, and regulations, and enforce them to ensure quality and delivery
- Engage the community and civil society at all levels and in meaningful ways, including through bylaws and national regulation
- Invest in health systems and inputs, including physical accessibility and quality
- Coordinate donor and NGO activities
- Ensure financial accessibility and protection through systems designed to ensure equity
- Engage the private sector as key partners in care delivery
- Plan for equity from the beginning

1.3 Conclusions

Contributors to Rwanda's success in reducing U5M include national- and ministry-level leadership, policies and strategies designed to create accountability, coordination, community engagement, data-driven innovation, equity, sustainability, and a commitment to primary care. These strategies were engaged and owned at all levels of the system, from the national to the district and community health levels. The country used an overarching strategic approach to implementing EBIs that encouraged the adoption of EBIs with adaptations as needed for Rwanda's context, moving quickly to scale, and continuously monitoring and assessing needs for possible improvements in interventions and implementation. The methods used in Rwanda offer lessons for other countries to consider with adaptation for their own cultures, health system structures, population health needs, and political and social environments.

2 Introduction

2.1 Exemplars in Global Health

The Exemplars in Global Health project was started by bgC3 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 or regions 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 (U5M)

As a part of the broader Exemplars project, the University of Global Health Equity (UGHE) is working with the teams at bgC3 and the Bill and Melinda Gates Foundation to better understand countries' successes in reducing under-5 mortality (U5M) between 2000 and 2015. This work was designed with two aims: 1) developing and testing an implementation 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 - 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.

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, with input from a technical advisory panel. These countries were chosen 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   Rwanda

The first of the seven countries chosen was Rwanda due to its success in decreasing U5M, outpacing many of its neighbors despite comparable or lower gross domestic product (GDP).

In 2000, Rwanda was still reeling from the 1994 genocide against the Tutsi and the public health crisis that followed. Decades of civil turmoil preceded the violent deaths of nearly one million people in only a few months in 1994. An additional two million people were displaced out of a population of six million, disrupting homes and communities across the overwhelmingly rural country. A new government faced the daunting task of reinstating the rule of law while creating an equitable path to development with few remaining structures in place.

At that time, Rwanda trailed the averages of both East African and Countdown countries in health expenditure per capita and in the number of births attended by skilled health staff. The country's income levels lagged behind those of its neighbors and other comparable developing countries, and foreign direct investment (FDI) was almost non-existent. Primary school completion rates were particularly low – just over half the rate of other Countdown and East African countries. And despite having the highest population density in sub-Saharan Africa, only 15 percent of its population lived in urban areas.[18]
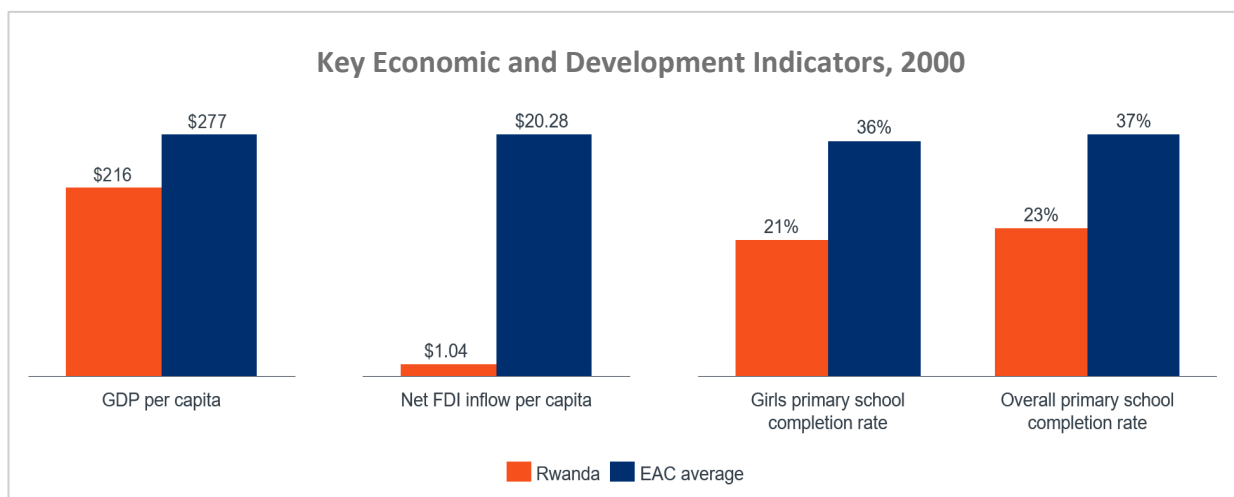
Figure 1: Key Economic and Development Indicators, 2000 (Source: World Bank, World Development Indicators)

Consistent gains are characteristic of the country's progress since 2000. Annual growth in its GDP averaged eight percent between 2000 and 2014. Between 2011 and 2014, the percentage of Rwandans living in poverty dropped from 45 percent to 39 percent.[19] The country's human development index score rose by over ten points from 2000 to 2012.[20]

The steady improvement which started in 2000 resulted in Rwanda benefitting from the Heavily Indebted Poor Countries (HIPC) Initiative from the World Bank and IMF.[21] Having completed all initiatives associated with HIPC, Rwanda was eligible for the 100 percent Multilateral Debt Relief Initiative from the World Bank, IMF, and AfDF.[22]

Integral to the policies and strategies was a commitment to reducing deaths in Rwanda's most vulnerable populations – children under five and pregnant women. U5M decreased from 196 deaths per 1,000 live births in 2000, among the highest in the world, to 50 deaths per 1000 live births in 2015, a rate on par with other countries in the region, including much wealthier countries in East Africa.[1,2] Eighty-five percent of this drop was driven by reductions in the post-neonatal time period. Like many other countries in the region, neonatal mortality also decreased, although at a slower rate, from 44 deaths per 1,000 live births in 2000 to 20 deaths per 1,000 live births in 2015 (see Figure 3).[1,2]
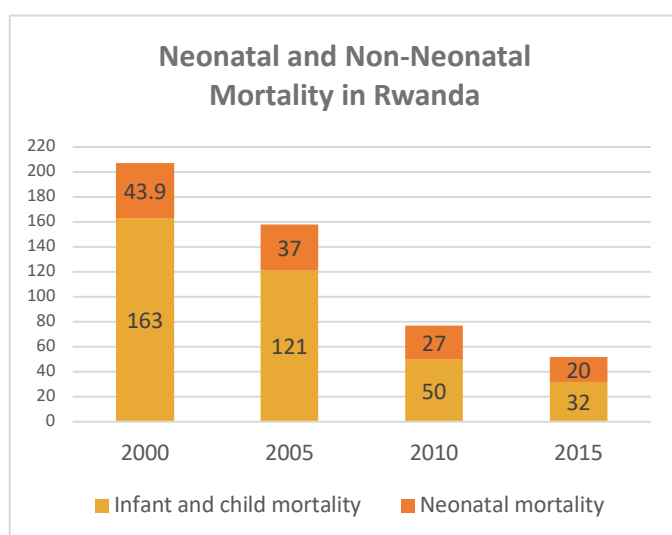
Figure 3: Neonatal and Non-Neonatal Mortality in Rwanda from 2000-2015 (Source: Rwanda DHS 2000, 2005, 2010 and 2015)
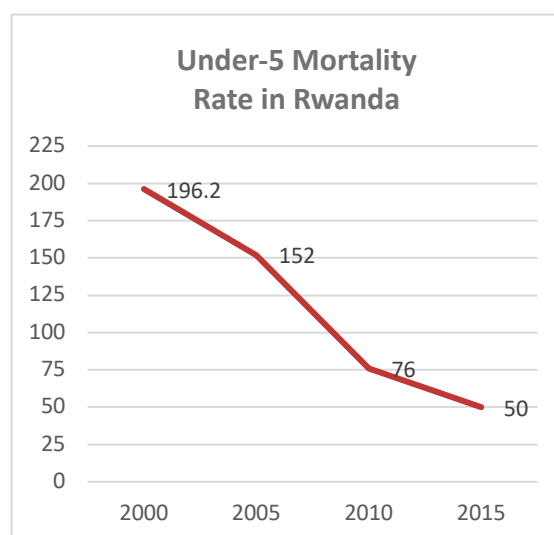
Figure 2: Under-5 Mortality in Rwanda from 2000-2015 (Source: Rwanda DHS 2000, 2005, 2010 and 2015)
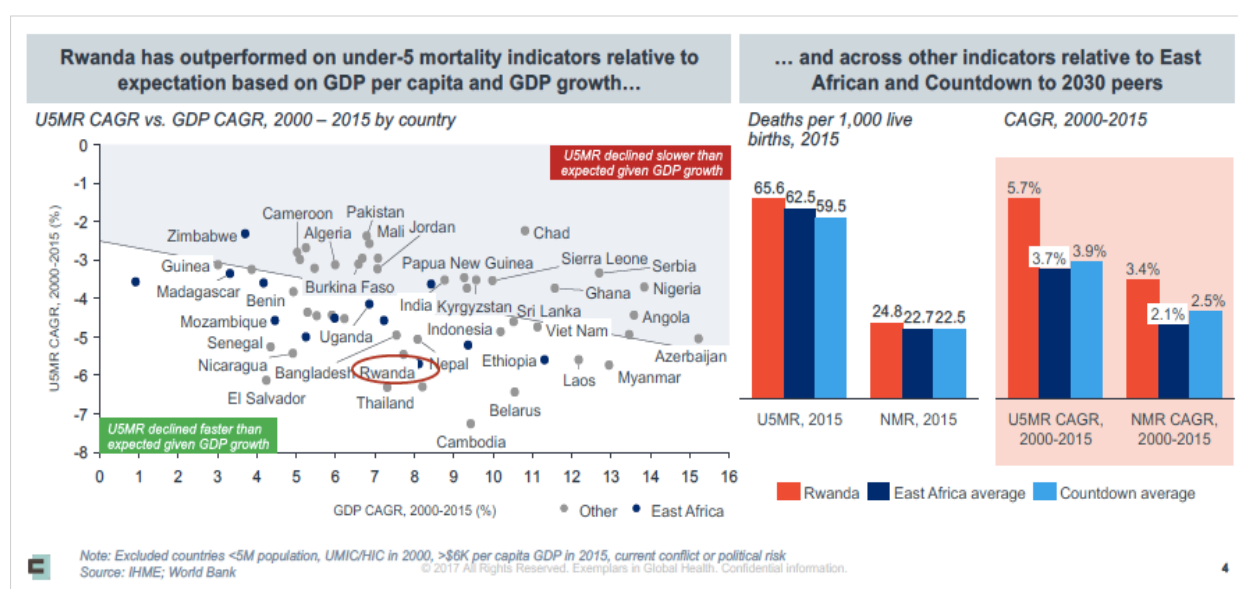
Figure 4: Regional and Global Comparisons of U5MR Reduction (Source: IHME, GBD Compare and World Bank World Development Indicators)

2.3.1 Burden of disease over time

The best available cause of death estimates show that the largest causes of death in 2000 were:

- Lower respiratory infections (pneumonia)
- Malaria
- Diarrheal diseases

Additional significant causes of death included malnutrition, measles, HIV/AIDS, and a range of neonatal conditions.[5]

Table 3: Under-5 mortality rates in Rwanda by cause of death (Source: IHME, GBD Compare)

Number of U5 Deaths per 1000 Live Births					
	1995	**2000**	**2005**	**2010**	**2015**
LRI	32.4	29.0	21.7	12.6	9.6
Measles	23.8	11.1	0.6	0.6	0.1
Malaria	21.1	21.4	5.1	3.8	3.9
Diarrheal diseases	20.5	16.5	16.9	8.1	4.2
Protein-energy malnutrition	13.6	12.6	10.1	5.7	4.4
Tuberculosis	5.7	3.8	1.9	0.9	0.7
Meningitis	5.6	5.2	4.4	2.9	2.5
HIV/AIDS	5.5	6.0	3.6	1.6	0.2
Total neonatal	26.9	28.1	24.3	18.6	16.3
Other	29.9	22.4	17.4	11.8	9.6
TOTAL	**185.0**	**156.2**	**105.9**	**66.7**	**51.5**

Figure 5: Causes of Death for Children Under-5 in Rwanda over Time (Source: IHME, GBD Compare)
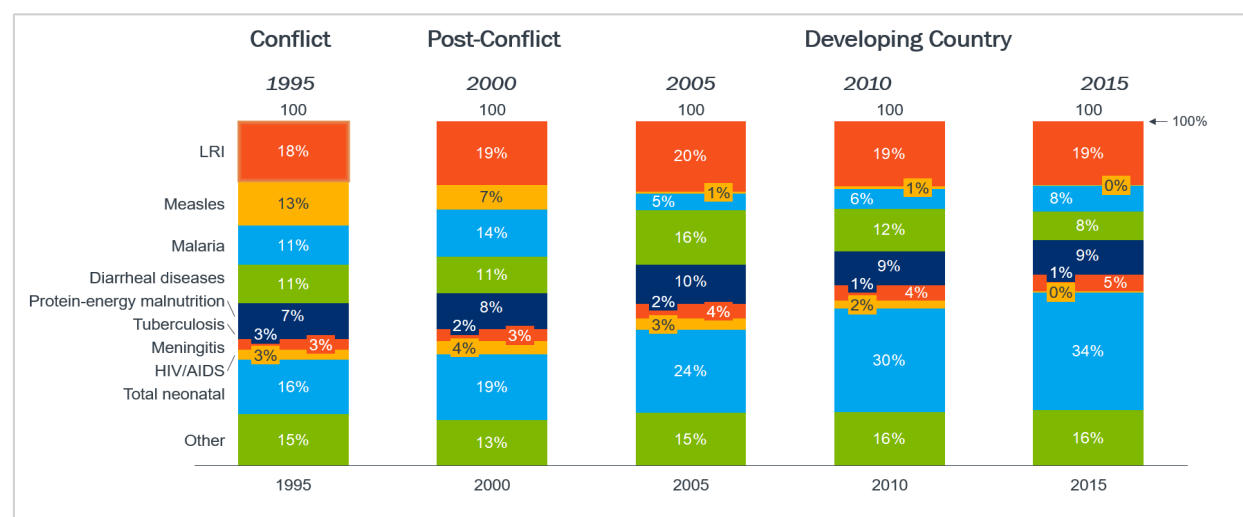
Since 2000, every major cause of U5M has seen a decrease in deaths per 1,000 live births:

- Lower respiratory infections remain the largest percentage of deaths in 2015. However, they have also seen the greatest absolute decrease from 2000, from 29 to 10 deaths per 1,000 live births
- Measles deaths reduced by 11 per 1,000 live births (11 to 0)
- Malaria deaths reduced by 17 per 1,000 live births (21 to 4)[5]

3 Methods

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 evidence-based interventions (EBIs) to reduce under-5 mortality 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 evidence-based interventions 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 and in the accompanying methods document.

3.2 Desk Review

The bgC3 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 Rwanda. Initial secondary research was performed through MEDLINE (PubMed) and Google Scholar using the search terms "child mortality" or "under-5 mortality" and Rwanda. 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 bgC3 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. 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, but have worked to include some evidence of increased coverage where available.

Note: Assessments of data quality or data collection methodology fall outside the scope of this study.

3.3   Primary Research

In collaboration with our consultant in Rwanda, 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 the close collaboration with in-country partners, prioritizing those EBIs that were reported as most successful, as well as any major EBIs for which no evidence of implementation was found in the literature. These key informants included current and former Ministry of Health employees responsible for overall direction or identified key specific disease or intervention areas. We also interviewed key individuals from NGOs, multilateral organizations or donor organizations, who had managed partner-supported or partner-led activities. We focused on individuals active in the time period between 2000 and 2015, but were able to also capture some experiences from 1995-2000 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. These were:
- Global and national level actors;
- Ministry of Health (MOH) actors;
- Project managers and implementers for specific causes of death or EBIs; and
- Other partners

Note: Some informants represented more than one view point based on their experience over the 15 years and were interviewed for each of their multiple viewpoints

The interviews were designed to address the EBI implementation process, from decision to implementation to sustainment. This includes critical contextual factors at the relevant global, national, ministry, and local levels. The interviews also identify additional sources of data and information which could be added to the knowledge base and understanding already developed from the desk review. Follow-up interviews were conducted as gaps or additional needs were identified.

Interviewees were informed about the goals and structure of the project, and consent for participation and recording was obtained separately from the interview (recording was solely for the purpose of reviewing notes). All interviews except one were led by one of the project PIs (Lisa Hirschhorn) with one to two note-takers. Following the close of the interview, notes were combined and the tape recording (if allowed) was used to clarify areas as needed.

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 cause of death 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 Rwanda was able to achieve success in decreasing U5M and what were the challenges. 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.

Key informant (KI) interviews were coded by one of the researchers and reviewed by one of the PIs for accuracy and the framework was used to extract the EPIS 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 work was approved by and conducted with the support of the Ministry of Health, National Health Research Committee, and Rwanda Biomedical Center's Division of Maternal, Child and Community Health. A waiver was obtained from the Rwanda National Ethics Committee on the grounds that this research was to be conducted entirely retrospectively, using de-identified data and desk reviews of existing reports, with informed consent obtained from all interview participants.

No quotes or specific viewpoints will be included which are identifiable to the source without explicit permission. All recordings and interviews had names removed and are kept in password protected computers and storage is on a limited access Google Drive. All recordings will be destroyed once the interview coding has been completed.

4 Specific Causes of Death and Evidence-Based Interventions

This section will focus on evidence-based interventions designed to address specific causes of death for children under-5 in Rwanda. See Appendix A for a complete listing of U5M causes of death and EBIs considered in this case study.

Table 4: Coverage of Selected U5M Interventions Based on Data Available from the DHS (Source: DHS 2000, 2005, 2010, and 2014 and DHS STATcompiler)

U5 Cause of Death	Intervention	2000	2005	2010	2014
Lower Respiratory Infections	Care-seeking for pneumonia	15.5%	27.9%	50.2%	53.9%
	Vaccination: 3 doses of PCV				94.7%
	Vaccination: Hib			92.9%	98.2%
Diarrheal Diseases	Oral rehydration therapy	20.2%	29%	36.6%	34.7%
	Vaccination: 3 doses of rotavirus				94.7%
	Care-seeking for diarrhea	15%	14.4%	41%	45%
Malaria	Insecticide-treated nets		12.6%	69.6%	67.7%
	Care-seeking for fever	8.7%	31.3%	44.8%	50.1%
	Treatment of children with fever by artemisinin-based combination therapy (ACT)			4.0%	11.2%
	Prompt treatment of children with fever by ACT			2.6%	7.4%
Measles	Vaccination: Measles	86.9%	85.6%	95.0%	95.2%
HIV	HIV counseling during antenatal care		55.8%	90.6%	93.0%
	HIV testing during antenatal care		21.5%	94.5%	97.9%
Other Vaccine Preventable Diseases	Full vaccination coverage with 3 doses DPT, 3 doses polio, measles and BCG	76.2%	75.5%	90.3%	92.7%
Neonatal Causes of Death	Antenatal care: 1+ visits by a skilled provider	92.5%	94.4%	98.0%	99.1%
	Antenatal care: 4+ visits by a skilled provider	10.4%	13.3%	35.4%	43.9%
	Antenatal care: 1st antenatal visit in the 1st trimester	4.7%	7.9%	38.2%	56.1%
	Vaccination: 1+ doses of tetanus toxoid during pregnancy	64.8%	63.4%	76.5%	79.6%
	Delivery in a health facility	26.5%	28.2%	68.9%	90.7%
	Delivery attended by skilled provider	26.7%	28.4%	69.0%	90.7%
	Delivery by C-section	2.1%	2.9%	7.1%	13.0%
	Postnatal care: Postnatal visit for baby within 2 days of birth	2.9%	3.7%	4.7%	19.3%
	Postnatal care: Postnatal visit for mother within 2 days of birth			17.6%	43.0%

Cross-cutting contextual factors were identified that were critical to successful implementation of each of these evidence-based interventions. These included:

- Empowered and engaged community
- Community trust in national government
- Donor support and coordination
- Robust health information systems
- Culture of and capacity for data use and learning
- Analysis and incorporation of best practices (including examples of success in other countries)
- Support from national leadership to build primary care and drop U5 mortality
- Culture of accountability at all levels of government
- Decentralization

4.1 Malaria, Diarrhea, and Pneumonia

4.1.1 Facility-Based Integrated Management of Childhood Illness (IMCI)[a]

EXPLORATION

Integrated Management of Childhood Illness (IMCI) is a strategy for the prevention and treatment of the most common childhood illnesses developed by WHO and UNICEF in 1996. IMCI specifically focuses on improving health providers' abilities to diagnose and treat common illnesses in high child mortality countries, strengthening overall health systems, and improving family and community health behaviors.[23] Strategies included both facility-based and CHW-based care. Rwanda decided to initiate IMCI at the facility level based on experiences observed from other countries.

PREPARATION

The Rwandan government adopted IMCI as national policy in 2000 following examples of success from other countries and created a national IMCI taskforce in 2001.[24] However, the Ministry of Health did not start training health providers until 2006.[24,25] Barriers to starting IMCI in health facilities included the need for significant human and physical resources.

IMPLEMENTATION

Scaling up IMCI to all health centers proved to be difficult. IMCI training lasted 11 days and had to take place in a district hospital in order to have enough patients for the training.[16] By 2007, only 23 percent of health centers had two or more IMCI-trained providers on staff.[26] Although the country originally aimed to have at least two providers trained in IMCI at each facility, this proved to be insufficient, as providers rotated on and off service (KI).

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[a] IMCI and iCCM cover three areas of disease. These are discussed first and then other EBIs for each cause of death, as well as broader epidemiology, are discussed in following sections

Table 5: IMCI Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability		IMCI is now considered standard of care for children U5 with fever, respiratory symptoms or diarrhea.
Feasibility	IMCI training nationally using the cascade train-the-trainers approach.	IMCI training for a health care provider costs approximately $1,000 USD for the original 11-day course and $600 USD for the shortened 6-day course.[24]
Effectiveness and Reach	Train all HC providers and ensure systems (supplies, M and E) in place at a national scale.	IMCI is available at every health center nationally with the goal of provision by IMCI-trained nurses.
Fidelity	Incorporating IMCI into routine supervision to measure and improve quality.	Providers focus on the symptoms that are visible or can be easily addressed, often not using the holistic IMCI approach with sick children (KI). Gaps in quality have been identified with supportive supervision implemented.

SUSTAINMENT

The standard IMCI training adopted in 2006 presented significant costs as well as took providers away from their health facilities for too long (11 days). In response to these problems, the MOH shortened the training to six days in 2011.[24] This reduced the cost of the training from $1,000 USD for the 11-day course to $600 USD for the shortened course.[24] There was no change in rates of accurate diagnosis and treatment of childhood illnesses by providers who received the shortened training as compared to those who underwent the longer version.[24] The shortened training time allowed for financial sustainability, less time away from local health facilities, and a higher number of providers trained.[16]

4.1.2 Integrated Community Case Management (iCCM)

EXPLORATION

In 2000, Rwanda faced a severe shortage of trained health care providers and facilities, resulting in low geographic access and poor coverage in the face of urgent public health needs.[27] The 2000 DHS showed that 53 percent of children under-5 did not receive any care or treatment for fever, and of those who sought care, only 17.4 percent received care from a health facility.[1] At that time, in Gikongoro province, only 30 percent of the population lived within 5km of a health center.[28] As well, 75 percent of the doctors and 50 percent of the nurses in the country lived in Kigali.[28] The Ministry of Health recognized that the low density of health facilities, many of which were often understaffed or geographically or financially inaccessible were contributing to the death of children under 5. Rwanda's CHW program had been in existence since 1995 but did not offer treatment for common childhood diseases. Rwanda learned that other programs in Kenya and Uganda were using trained volunteers to treat children with fever, offering

models for Rwanda to develop within their local context.[29] A decision was made in 2004 to expand the scope of CHWs to include management of childhood illnesses responsible for a significant proportion of U5M starting with the adoption of home-based management of fever (HBMF) with plans to later expand to integrated CCM (iCCM) as funds became available.

PREPARATION

Work started with identifying needed resources and funding. Support for CHW treatment of fever in children came from the Global Fund to Fight AIDS, TB and Malaria (GFATM). MOH officials visited Kenya and Uganda to better understand their successes and challenges to inform development of the program, protocols and strategy. The MOH established a home-based management working group who wrote a strategic plan, created training manuals and guidelines, and designed the kits for the CHWs.[30] The MOH piloted the program in six districts, three overseen by NGO implementing partners and three overseen by the MOH Integrated National Malaria Control Program. This was externally evaluated after two years to assess impact, lessons learned and challenges prior to scaling-up nationwide.[30] This review showed that, in most locations, the percentage of children receiving treatment within 24 hours of onset of fever had increased to more than 80 percent and reported cases at health centers had decreased.[30] However, the review of the pilot program emphasized the need for increased training and supervision of CHWs, as well as integration of both other malaria prevention and control policies and management of other childhood illnesses into the scope of the CHWs work. As a result, national scale-up was planned with a number of adaptations.

IMPLEMENTATION OF HBMF AT A NATIONAL LEVEL

By 2007, CHWs nationwide had undergone training at their local health centers on HBMF, using a cascade, train-the-trainers system with a standardized national curriculum.[31] They were taught signs and symptoms of malaria, treatment of disease, warning signs requiring referral to a health facility, drug management, and reporting systems. They used prepackaged medications with instructions in Kinyarwanda, illustrated with drawings to assist both the CHWs and the children's care givers in fidelity and adherence to recommended treatment. The CHWs report the cases treated and commodities used and accordingly collected supplies from local health centers through a national system from national stores through district hospitals to the HCs.[30] Following nationwide implementation of HBMF, implementation outcomes included feasibility, fidelity, and acceptability, with treatment for children under-5 with fever within 24 hours of onset increasing to 63 percent in 2008, 84 percent in 2009, and 89 percent in 2010.[32]

EXPANSION TO iCCM

Concurrently with nationwide scale-up of HBMF, the MOH also explored the expansion of the CHW program to encompass iCCM of diarrhea and pneumonia in children under-5. NGO partners, including Concern Worldwide, the International Rescue Commission, and World Relief, supported the MOH in runnig a pilot program in six districts starting in 2007 that supported CHW-delivered treatment of all three illnesses.[33] MOH officials also visited Senegal to assess their iCCM program. Based on the data from this pilot and lessons from the success of the Senegal program, the MOH showed feasibility through scaling up iCCM to all 30 districts between 2008 and 2011.[29] Using national strategic plans, existing data, a formal technical working group, and the support of high-level cabinet officials, the MOH mandated all implementing partners to adopt the new roles for CHWs. Communities easily accepted the increased care

available from CHWs due to witnessed improvements following HBMF, the MOH investment in community sensitization and engagement, and a culture of trust in the national government.

> *When we started with malaria only, the communities saw the change in mortality. So when pneumonia and diarrhea were added, the community was like, "Oh you took so long. This is what is killing our children." (KI)*

Just one year after implementation of iCCM, districts saw increases in the number of children treated for diarrhea and pneumonia (0.83 cases/1,000 child-months to 3.80 cases/1,000 child-months and 0.25 cases/1,000 child-months to 5.28 cases per child-months respectively).[29] Additionally, there was an observed decrease in under-5 mortality and health facility use beyond what current trends would have suggested. U5MR significantly declined by 38 percent and health facility use significantly declined by 15 percent.[29]

Table 6: iCCM Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability	Introduction of HBMF prior to expansion to community-based treatment of pneumonia and diarrhea.	Improvements in child health due to HBMF helped communities immediately accept the expanded role of CHWs with iCCM.
Reach and Effectiveness	Nationwide implementation using established CHW program with 3 CHWs per village.	Treatment for children under-5 with fever within 24 hours of onset increased from 53% in 2000, to 63% in 2008, 84% in 2009, and 89% in 2010.[32]
Feasibility	Utilization of existing CHW program, decentralization of supply chain.	Since the introduction of ACT in 2006, there have been no large or repeated stock-outs of ACT at health facilities nationwide.[11]
Fidelity	Standardized national curriculum, prepackaged medications, documents and materials in local language.	U5MR significantly declined by 38% and health facility use significantly declined by 15%.[29]

SUSTAINMENT

The Ministry of Health made a number of strategic decisions aimed at increasing potential for sustainability of the program and impacts. They regularly adjusted their national iCCM treatment policies based on changing scientific developments, national data on coverage and diseases, resistance patterns for malaria, and international recommendations. For example, national malaria treatment policies were updated frequently over time to reflect new practice locally learned and published knowledge. In 2001 the country changed first-line antimalarial treatment policy from chloroquine to amodiaquine and sulphadoxine-pyrimethrine (AQ+SP) based on resistance monitoring within the country.[11] In response to ongoing monitoring of increasing drug resistance and changing international recommendations for treatment, the MOH introduced artemisinin-based combination treatment (ACT) as the new national policy for first-line

treatment in health facilities in 2006.[10] After health centers showed sharp drops in malaria cases with this change in treatment, in 2007 the MOH adopted ACT as first-line treatment in community settings as well. CHWs were able to use the same supply chain as for the antimalarial medications, and as such, no increase in infrastructure was needed to accommodate this intervention reflecting the strategy of using existing systems. Children with fever receiving parasitological testing prior to antimalarial treatment increased from 45 percent in 2008 to 94 percent in 2010.[10] To ensure a sustained supply of drugs, the MOH has invested in the supply chain and system for restocking the CHWs. Like for all other commodities, CHWs pick up the medication supplies at their nearest health center when they drop off their monthly reports. There is an alignment between use of supply and pick up by CHWs and since the introduction of ACT in 2006, there have been no large or repeated stock-outs of ACT at health facilities nationwide.[11]

With the data showing both decreasing rates of malaria and routine increases in resistance, the MOH considered treatment of all children with fever no longer best practice. In 2008, they piloted training of CHWs to use rapid diagnostic tests (RDTs) for malaria in order to treat only confirmed cases. Using a cascade training system, where MOH experts trained district hospital workers who trained CHWs, community-based rapid diagnostic testing expanded nationwide.

4.1.3 Other Malaria Interventions

In the year 2000, malaria was among the top causes of morbidity and mortality for children under 5 in Rwanda, estimated at 18 per 1,000 live births, and only surpassed by diarrheal disease and neonatal causes of death.[5] At that time, there was limited financing for malaria prevention and control programs, extremely limited insecticide treated net (ITN) distribution and use, and no indoor residual spraying. In 2000, only 15.5 percent of children under-5 in Rwanda slept under a mosquito net at night.[1] Over the next 15 years, the malaria mortality rate for children under-5 reduced to six per 1,000 live births.[5]

Throughout the Rwandan government's strategy to reduce malaria-related death, certain themes are clear. They have used a consistent strategy of relying on data to guide their decision-making, nationally coordinated donor and partner activities around on national program and relied on decentralized community and facility-based care. Within this context, the interventions they have implemented related to a significant drop in this cause childhood mortality.

Table 7: U5M Caused by Malaria in Rwanda over Time (Source: GBD Compare)

Number of under-5 deaths caused by malaria per 1000 Live Births				
1995	**2000**	**2005**	**2010**	**2015**
21	18	12	8	6

EXPLORATION

Similar to other U5M intervention implementation in Rwanda, the decision to target malaria and how to put the policy into action depended largely on available data and evidence. The MOH first worked to understand the burden of disease and the needs of different districts to properly prioritize their efforts. "We need to know where our endemic areas are? What districts have high and low burdens? Where do we need to target?" (KI)

The National Malaria Control Program at the Ministry of Health first created a strategic plan for malaria for the years 2006-2010. In this plan, they dedicated themselves to achieving specific targets related to pregnant women and children under-5 sleeping under ITNs or in homes treated with IRS; women receiving IPTp during pregnancy; availability of ACTs for facility-based treatment of malaria; and timely treatment of children under-5 with suspected malaria.[34] These efforts had the support of GFATM, the Presidential Malaria Initiative, and UN agencies, and all strategies and interventions were developed with the leadership of the Rwandan MOH.[35]

Rwanda chose to employ a variety of EBIs (in addition to iCCM) available at the time including: 1) distribution of long-lasting insecticide treated bed nets (ITNs), 2) targeted indoor residual spraying, and 3) expansion of both facility-based and community case management. Implementation included a focus on community engagement, leveraging CHWs, and updating based on changing evidence.

4.1.3.1   Insecticide-Treated Nets

PREPARATION

During the late 1990s and early 2000s, non-treated mosquito nets were distributed primarily to pregnant women, children under-5 and HIV positive patients during antenatal care visits, vaccinations, and other interactions with health care providers.[10] When ITNs were introduced in Rwanda in 2006, the Ministry of Health changed their distribution strategy to nationwide mass-distribution campaigns. This required close collaboration with donors – with GFATM for the first campaign in 2006 and the Presidential Malaria Initiative in 2008 – and other divisions in the MOH and affiliated institutions, such as TRACPlus in the beginning and RBC after 2011 when those affiliated institutions in that institution were merged. In 2006, the National Malaria Control Program integrated their first mass campaign with a nationwide measles vaccination campaign, working with CHWs to distribute the nets. Future campaigns occurred during national Maternal and Child Health week, in coordination with larger community health efforts.[35]

IMPLEMENTATION

 In 2006, the first mass-distribution campaign of ITNs targeted only pregnant women and children under-5. Over 3 million ITNs were distributed between 2006 and 2007.[10,11] This campaign showed drastic and immediate effect, monitored using the national census and data collected from local leaders. The percent of the population sleeping under bed nets treated with insecticide increased from 13 percent in 2005, to 28 percent in 2006, and 59 percent in 2007.[11] Following this success, the malaria program with the support of the Presidential Malaria Initiative did a mass campaign in 2008-09 that scaled up to all households. More than 6.1 million nets were distributed during these two years.[10,11] By 2010, 82 percent of households owned at least one mosquito net and 70 percent of children under-5 slept under them.[9] National policy changed

to prohibit the importation of untreated bed nets in 2008 in order to encourage the use of treated nets.[10] On the local level, CHWs take an active role in the distribution and proper use of bed nets. Part of their household need assessment is to confirm that every home has the necessary number of bed nets and that the nets are being hung properly. This is a key indicator the CHW must report to health centers regularly.

Table 8: ITN Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability	Mass campaigns, using CHWs and other nationwide health campaigns	See Reach
Reach	Nationwide approach to sensitization and bed net distribution	Percent of children under-5 sleeping under ITNs increased to 68% by 2015[2]
Effectiveness	Combine with other interventions; when reported nationwide increase of malaria incidence, MOH tested of ITN effectiveness and when found that ITNs were not effective as long as expected Increased frequency of distribution campaigns	See overall malaria results
Feasibility	Integration into existing nationwide campaigns and community health program	Over 3 million ITNs distributed during 2006-2007 and 6.1 million distributed during 2008-2009 [10,11]
Fidelity	CHWs check homes for proper use of ITNs	ITN utilization is approximately 10% less than ITN possession (KI)

SUSTAINMENT

While initially the drop in malaria was sustained, a notable challenge to sustainability was seen in 2009, when 28 out of 30 districts independently reported increases in the incidence, prevalence, morbidity, and mortality of malaria.[36] After extensive investigation of treatment, environment, and community attitudes, it was eventually discovered that the fault laid with the ITNs. Although WHO-certified to last three to five years, independent efficacy monitoring showed that the nets had reduced efficacy starting at 18 months. Coverage with ITNs dropped from near universal to 60
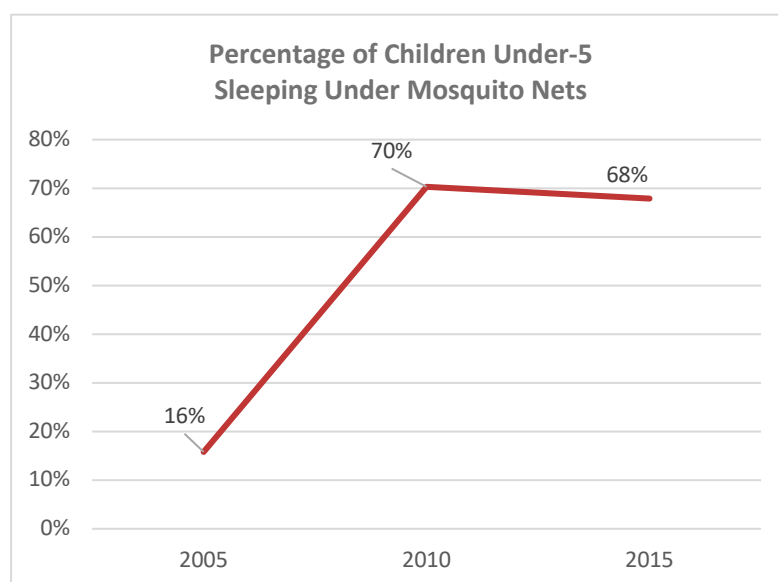
Figure 6: Percentage of Children Under-5 Sleeping Under Mosquito Nets (Source: Rwanda DHS 2005, 2010, and 2015)

percent in 2006 and 24 percent in 2009.[36] Using collection and analysis of monthly HMIS data, the MOH strategically distributed the remaining ITNs to those areas most heavily affected. Using the data, the MOH also successfully submitted a grant for new funding to GFATM and a year later, GFATM funded another distribution campaign with mass bed-nets distribution in targeted districts at risk.

4.1.3.2 Indoor Residual Spraying

PREPARATION

The National Malaria Control Program did not include nationwide indoor residual spraying (IRS) in their strategic plan due to cost considerations.[34] Instead, IRS was piloted in three districts in Kigali starting in 2007. Prior to spraying, the MOH required detailed meteorological data from the Rwanda Meteorological Services to determine the start and end of rainy seasons and therefore the appropriate times for spraying.[34] Other required preparation included logistics assessment for amount of insecticide, equipment, and storage facilities needed; environmental assessment to assist in choosing the appropriate pesticide; and identification of options for local incineration of empty insecticide sachets.[37] CHWs were recruited as community sensitizers, and spray operators, taking advantage of existing resources in the chosen districts.[38]

IMPLEMENTATION

IRS expanded to five more districts over the following two years once feasibility and acceptability was confirmed.[11] The strategy included targeting high risk population with the 15 percent of the population living in homes that had been sprayed in 2010, representing the seven districts targeted responsible for 70 percent of the malaria burden in Rwanda.[10] The study leveraged the existing CHW capacity who served as community sensitizers and spray operators.[38] The CHWs also implemented community engagement and sensitization and communicated with their communities prior to the day of spraying so that families could prepare their homes including moving all of their food outside.

Table 9: IRS Implementation Strategies and Outcomes

	Implementation Strategy	**Implementation Outcomes**
Acceptability	Community engagement and sensitivity.	General acceptability came about after seeing the lack of mosquitoes following the first round of spraying.
Reach	Choice of pilot districts based on evidence of high burden of disease.	Seven districts covered by IRS represent 70% of the malaria burden for the country. [10]
Feasibility	Utilization of existing community health workers program as both sensitizers and spray operators.	In the districts chosen, 87-99% of targeted buildings are sprayed. [11]
Fidelity	Training, supply chain strengthening.	N/A

Prior to the first round of IRS in Kigali, the local community expressed doubts about the process. However, after they witnessed the continued lack of mosquitoes three months following spraying, the community found this process acceptable and desired. Although implemented in a limited number of districts, coverage rates are 87 to 99 percent of targeted homes.[35]

4.1.3.3 Intermittent Preventative Therapy in Pregnancy

Intermittent preventative therapy in pregnancy was started in Rwanda in 2004, but reflecting data-driven decision making, was discontinued in 2008 due to data showing significant parasite resistance to the recommended drug (sulfadoxine-pyrimethamine).[32]

4.1.3.4 Ongoing Challenges to Malaria Control and Treatment

Since 2012, malaria cases and deaths in Rwanda have steadily risen.[32] Contributors to this increase may include continued reduced efficacy of ITNs and delays in procurement and distribution of new nets. There are also limitations in the reach of the IRS program due to budget constraints and insecticide resistance. Significantly, similar increases in rate of malaria have occurred across East Africa, indicating that more global forces may also be at play, including changes in regional temperature and rainfall. Work has already started to address these issues building on a malaria emergency plan and strategies used to implement the new malaria EBIs including coordination among different ministries, data utilization, and efforts to create sustainable financing.[b]

4.1.4 Other Pneumonia Interventions

In addition to case management with iCCM and IMCI, Rwanda implemented access to two vaccines to decrease the morbidity and mortality of pneumonia in children under-5. Lessons from this were applicable across the implementation of other vaccines.

4.1.4.1 Pneumococcal Vaccine

EXPLORATION

In 2007, pneumonia was the leading cause of death for children under-5 in Rwanda.[5] That year, the WHO added the pneumococcal vaccine (PCV) to their list of recommended routine childhood immunizations.[6] Due to this combination of data showing the burden of disease and available interventions, the Rwandan Ministry of Health vaccine steering committee, chaired by the Permanent Secretary in the MOH, comprised of MOH officials and national and international partners, to explore the feasibility of PCV rollout in Rwanda.[7] Rwanda seized the opportunity and rapidly decided to move forward, becoming the first country in sub-Saharan Africa to introduce the vaccine.

PREPARATION

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[b] GHD Malaria Case study

To start, Rwanda performed a nationwide evaluation of the cold chain, leading to the MOH acquiring new storage space, cold rooms, and incinerators.[7,8] The glass syringes used for the PCV at the time required significant storage space and higher temperature incinerators for destruction after use than existed at the time.[19] The Ministry of Health also assessed the country's financial capacity to adopt PCV, and the PCV technical committee reviewed the safety and efficacy profiles of the vaccine prior to implementation.[7] In 2008, Rwanda submitted a proposal to the GAVI Alliance; GAVI, the MOH and other private donors shared the financing of the rollout, including the donation of the PCV-7 vaccines by the manufacturer.[39] The country further prepared for the vaccine introduction by developing training modules for vaccinators, then using a cascade, train-the-trainers model for dissemination of training from the central level to the district and local health centers. They revised vaccination guidelines, reporting forms, tracking documents, and developed key messages for parents and caretakers.[8] CHWs performed a need estimation by counting the number of children under 1-year in their catchment areas and then comparing to UNICEF estimates.[7] The Rwandan MOH chose not to pilot the vaccination prior to nationwide implementation due to confidence in their pre-implementation evaluation of the project and a commitment to equity (KI). The MOH also procured higher temperature incinerators capable of appropriate disposal of the glass syringes after use.

IMPLEMENTATION

Implementation of the PCV started in 2009. It rolled out province by province as planned, with completion within five months of the start date. Strategies were used to ensure equity of coverage remote areas were reached including using motorcycles and cold boxes, and CHWs monitored the vaccination status of the children in their villages to determine which areas needed additional vaccination days.[7]

Table 10: PCV Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability	To increase acceptability of the new vaccine, sensitization efforts included awareness days for local leaders, teachers, and traditional healers; outreach through newspapers, radio and television; community meetings; and outreach by CHWs.[7] CHWs taught their communities the risks and benefits of vaccinations based on key messages created by the MOH, specifically aiming to address concerns parents might have about the vaccine.[8]	The communities generally accepted the benefits of the vaccination because "[Rwanda's] population trusts very much their government and what they are doing and that [the MOH's] main interest is our beneficiaries." (KI)
Feasibility	The supply chain and M&E were successfully adapted with data use to identify gaps in coverage which were addressed through outreach.	No stockouts occurred during the vaccine rollout.[8]
Fidelity	During 2009 and 2010, MOH officials performed supervisory visits at every health center and then provided feedback on the vaccination campaign.[8]	The roll out was completed as planned within 5 months.

Effectiveness and Reach	Cold storage and infrastructure assessment and investment; cascade training for vaccinators; need estimation by CHWs; nationwide, province-by-province, rollout over five months.	After introduction, PCV coverage quickly increased up to 97% by 2010 with a concurrent reduction in child hospitalization due to pneumonia of 53% between the periods of 2007-2009 (prior to introduction of PCV7) and 2010-2013 (after introduction of PCV7). [11,40]

SUSTAINMENT

Full vaccination rates with PCV have remained consistently high since introduction, with coverage at 97-98 percent since 2010.[9] The MOH has integrated the vaccination into its standard pediatric vaccine schedule, and they offer community-based PCV immunization every 6 months during national Maternal and Child Health weeks for those who have missed vaccinations.[7] Monthly M and E data on vaccination rates are gathered by CHWs and local health centers, and then coordinated and analyzed at the central level with feedback to address coverage gaps.[7] To sustain the PCV vaccination the government of Rwanda secured the needed funding in the annual national budget.

In 2011, Rwanda adapted the approach, switching from vaccinating with PCV-7 to the newly available PCV-13. The new vaccine formulation not only protected against 6 more strains of the bacteria, but also required less cold storage and lower incineration temperatures. These changes also allowed for future adoption of new vaccines which had similar storage and disposal needs with little increase in infrastructure. The success of the PCV rollout and analysis of training, supply chains, and surveillance informed the strategy for introduction of other new vaccines in Rwanda in the future.[7,8]

4.1.5   Other Diarrhea Interventions

4.1.5.1   Rotavirus Vaccine

EXPLORATION

In 2008 rotavirus was attributed to 37 percent of childhood deaths due to diarrhea and 5 percent of deaths in children under the age of 5 globally.[41] Between December 2010 and April 2011, the laboratory at CHUK found that 30 percent of pediatric patients' stool samples tested positive for rotavirus.[7] In response to this high burden of disease and the announcement by GAVI that they would fund roll-out of rotavirus vaccination, the MOH established a technical committee to assess the feasibility and cost of adding rotavirus to the standard vaccination schedule.[7]

PREPARATION

In 2010, in preparation for the planned roll-out of rotavirus vaccination in 2012 (as well as HPV in 2011), Rwanda initiated a number of implementation strategies targeting evaluating the supply chain to identify strengthening needed to accommodate additional vaccines, community awareness and adapting the existing monitoring system to evaluate the rotavirus roll out. While the rotavirus vaccine was designed to fit within the existing vaccination program, a needs assessment conducted using the WHO Logistics Forecasting Tool to estimate the additional needed storage capacity at central and district levels. While at the central level, no additional need for cold chain development was identified, additional need for storage

capacity at the district level was identified to accommodate the new vaccines, including new refrigerators and 40 cold boxes to distribute from the central to district levels. At the health center level, 120 out of the 426 facilities with immunization activities were identified as needing additional refrigeration capacity with120 additional vaccine carriers were required to fill the service provision gap. As part of the rotavirus implementation strategy, a number of steps were also made to ensure acceptability, effectiveness and sustainability.

1. **Engagement with partners** was done with advocacy efforts were planned to help fill the identified supply chain and resources gap and ensure close coordination and availability of resources
2. **Community sensitization and education** on the new vaccine with development of key messaging, and dissemination of key information to the community.[42]
3. **Revision of all EPI data collection and management tools** to monitor the success of this intervention, with rotavirus surveillance activities integrated into Pediatric Bacterial Meningitis Surveillance system.[42]
4. Health facility-specific **timelines** for roll-out were developed.[7]

IMPLEMENTATION

The roll-out was funded by an introductory grant from GAVI to which the country applied successfully using existing data, with the remaining costs needed (counterpart funding) covered by the Government of Rwanda.[7] The vaccine cold chain and transport equipment inventory were upgraded based on the determined needs. In May 2012, Rwanda became the first low-income African country to roll-out routine rotavirus vaccination. Integrated into the routine vaccination schedule and system, three doses of rotavirus vaccine given at six, 10, and 14 weeks as recommended.[43] Similar to the pneumococcal vaccine roll-out, the Ministry of Health implemented a cascade train-the-trainers strategy for the roll-out.[7] Community volunteers were recruited to raise awareness and increase community understanding of the benefits of the rotavirus vaccine.[7] According to one KI, it was very easy to administer the vaccine because mothers were not afraid of it. Reportedly, "it came at the right time," meaning people had seen the success of prior vaccinations (in particular, measles) and they wanted the same reduction in diarrhea, in addition to the vaccine being implemented during diarrhea season. Furthermore, the informant indicated that roll-out had additional success because communication of messaging and training was made easier by the fact that there is a common language in Rwanda and because vaccines are available free of charge for families.

Table 11: Rotavirus Vaccine Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability	Community education and engagement and advocacy – through community volunteers at every health facility, with messaging directed by focus groups. Dissemination of other materials.	High coverage rates reflecting community acceptance: "It was very easy to administer the vaccine because mothers were not afraid of it."

Feasibility	Gaps in supply and cold management chains were identified and addressed Close follow-up with engaged partners. Training of CHWs and clear vaccination schedule.	Rotavirus vaccine was delivered nationally.
Fidelity	Revise EPI data collection tools, integration into existing schedule. During capacity-building training, the importance of care of the vaccine stock and tests of quality was emphasized in order to reduce vaccine loss.[7]	Three doses of rotavirus vaccine are being given at 6, 10, and 14 weeks as recommended.[43] With the rollout completed as planned (partner engagement and coordination, community sensitization, integrated strengthening of supply and M&E systems).
Effectiveness and Coverage	Health facility-specific timelines for roll-out were determined, cold and supply chain strengthening undertaken.	Rotavirus vaccination in children under 1-year of age increased from 50% in 2012 and to 99% in 2013[44] Hospital admissions for diarrhea in children under-5 fell by 49% between 2011 and 2013.[45]
Sustainability	Integrated monitoring into existing EPI system with continuation of vaccine sensitization and delivery, integration into routine vaccination and broad strengthening of vaccination supply chain.	

Rotavirus vaccination in children under 1-year of age increased from 50 percent in 2012 and to 99 percent in 2013.[44] Implementers saw an immediate reduction in cases of diarrhea following roll-out of the vaccine, including both annual and seasonal cases. Data showed that hospital admissions due to diarrhea in both vaccine-eligible (less than 1 year of age) and vaccine-non-eligible (ages 1 to 5) children decreased immediately following implementation of the rotavirus vaccination, suggesting an element of protection through reduced transmission.[44] Hospital admissions for diarrhea in children under-5 fell by 49 percent between 2011 and 2013, accounting for 12 percent of total child under-5 admissions.[44]

SUSTAINMENT

As part of the sustainability strategy, the MOH continued the integrated monitoring of coverage as well as the national supply chain and secure the counterpart funding in the annual national budget. In 2015, 95 percent of children age 12-23 months had received all 3 doses of the rotavirus vaccination.[2]

4.2   HIV

The national HIV program in Rwanda started initially as a vertical and externally funded program, but starting in 2005 services were rapidly harmonized into a program that was based on the national vision and strategic plan. Similar to other intervention implementation strategies, HIV-related services were supported by data and M&E, ongoing incorporation of new evidence to inform guidelines, decentralization, and adaptation. We focus on the prevention of mother-to-child transmission (PMTCT) and pediatric HIV treatment programs as EBIs to reduce under-5 mortality.

4.2.1   Prevention of Mother-to-Child Transmission (PMTCT)

EXPLORATION

Prioritizing PMTCT in the national HIV strategy resulted from local, national, and global data, as well as from advocacy of health care providers. The University Central Hospital of Kigali (CHUK) had been systematically testing for HIV among pregnant women since 1989, providing data on the burden of disease. When research findings were published on effective PMTCT regimens, health care providers at CHUK who had been following HIV-positive mothers championed the cause of PMTCT. According to one KI, providers used local and global data on the risk of transmission and the prevalence rate in this population to push the MOH to prioritize PMTCT among the national priorities and engaged in discussions on developing a national PMTCT strategy. HIV testing for women who were pregnant or planning pregnancy was a core part of the strategy, along with linking these women into HIV care. This was viewed as critical to both prevent transmission and to identify children who were HIV-positive or are at risk of becoming infected through breastmilk postpartum.

PREPARATION

Reflecting the burden of HIV among pregnant women identified at CHUK, the PMTCT program was piloted in Kigali in 1999. This PMTCT program included pretest HIV counseling, routine HIV testing at ANC visits, prophylactic antiretroviral (ARV) treatment for HIV-positive pregnant women, health education on HIV and PMTCT, and development of health information systems for tracking the number of women in need of and using PMTCT services.[46] During the three years of piloting at Kicukiro Health Center, 100 percent of women were counseled on HIV testing at their ANC visit, 86 percent received testing, and 63 percent of HIV-positive women received ARV prophylaxis.[46] According to one key informant, women would travel across the country for the PMTCT services offered during the pilot phase of this program. This posed a significant demand for services beyond what providers and facilities could reasonably handle. Prior to national scale-up, the MOH recognized the need for broad capacity-building and preparation to be prepared to serve a high number of patients.

In 2001, the Treatment and Research on AIDS Center (TRAC) defined national goals for PMTCT in the National Strategic Plan against HIV.[47] In 2001, there a small number of partners involved, with the initial phase was only supported by UNICEF and Elizabeth Glaser Pediatric AIDS Foundation. In 2002, Rwanda received a US $34 million grant from the Global Fund for strengthening the capacity of health facilities for antiretroviral therapy (ART) services for adults and children and PMTCT. In 2004, Rwanda received further donor funding through a $39 million grant from PEPFAR to increase access to ART and PMTCT services.

Preparation for PMTCT included engaging with providers and leadership at all levels to ensure understanding and support, integration of M&E through a data system and building accountability including through *imihigo* contracts.

In 2005, a PMTCT technical working group was formed, chaired by the head of the National AIDS Control Commission and comprised of government agencies, international partners, and local organizations. Out of those meetings, additional ANC and service delivery standards were developed and issued. Health reporting for HIV was slow and data quality a challenge associated with traditional paperwork being processed through health facilities up to the district level for compilation and then up to the central level. Recognizing the need for real time monitoring and evaluation, a health information management system called TRACnet was created.[c] TRACnet instead utilized reporting from mobile phones to provide timely medical utilization data.[48]

IMPLEMENTATION

In 2006, the national scale-up plan for PMTCT was introduced with the goal of comprehensive PMTCT integrated into MCH at the community level.[47,49,50] This plan had multilateral support from the MOH, Global Fund, PEPFAR, UN agencies, and civil society organizations.[49] During national scale-up, the protocol was changed from AZT to Nevirapine due to changing international recommendations for treatment. To ensure quality and adherence to national protocols, performance-based financing for health care providers included key HIV care indicators, including the number of HIV-positive pregnant women put on ART during labor.[48] Like other EBIs implemented in Rwanda, the PMTCT program benefited from the singular national vision for health. According to one key informant, "A good thing is that the implementation of HIV program in Rwanda is guided by one national guideline, and every partner in country is aligned to that. No partner should implement a different protocol different from that."

Table 12: PMTCT Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Reach	Build health posts with ANC and outreach services in remote and inaccessible areas, providing entry points to PMTCT Plan for decentralized scale-up with clear guidelines and protocols.	In 2015, 92.2% of pregnant women received HIV testing during ANC, and less than 1% were HIV-positive.[2,51] All HCs by 2009 offered ART, including PMTCT.

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[c] GHD case study

Effectiveness	Use monitoring tools and programs to flag and track missed appointments and loss-to-follow-up for individual women and infants. Review and update national guidelines every two years in collaboration with partners and based on evidence.	98% of women coming in for antenatal care are tested for HIV and 99% of HIV-positive pregnant women receive ART to reduce MTCT (KI) MTCT rates have dropped from 9.7% in 2006 to 2.4% in 2010 and 1.8% in 2015.[12–14] Adoption of improved treatments often prior to international recommendations by WHO and other bodies – most notably, Option B+.
Feasibility	Integration of PMTCT capacity building into maternal health services and relate health systems strengthening, one national guidelines, and donor coordination.	Increased ANC services available led to increased availability of PMTCT (KI). The number of health facilities offering PMTCT increased from 53 in 2003 to 382 in 2010.[12]
Fidelity	Monitoring of scale-up and ongoing services, integration into PBF, clear guidelines supported by training.	See Reach.

SUSTAINMENT

Every two years, the Ministry of Health, in collaboration with local and international partners, reassesses the treatment policies for PMTCT. Consequently, they have frequently changed the national policies based on changing data and international recommendations. This was seen in the change from single-dose Nevirapine to dual therapy for mother in 2005, and the adoption of Option B in 2010.[49] This second adaptation was met with a great deal of criticism because Option B was expensive and dependent on donor funding, and as such, the technical working group instructed against it. Option A was considered a cheaper option also recommended by the WHO.[52] However, implementers in Rwanda felt that Option B was more beneficial for patients and their communities, and it gave them the opportunity to reduce any resistance related to monotherapy. They argued that that Option B was the most cost-effective option in the long run by preventing many more new cases of HIV which would
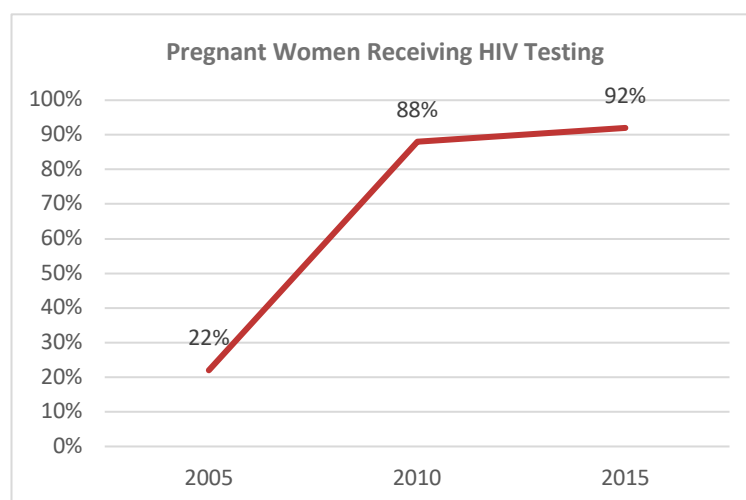
Figure 7: Pregnant Women Receiving HIV Testing (Source: Rwanda DHS 2005, 2010, and 2015)
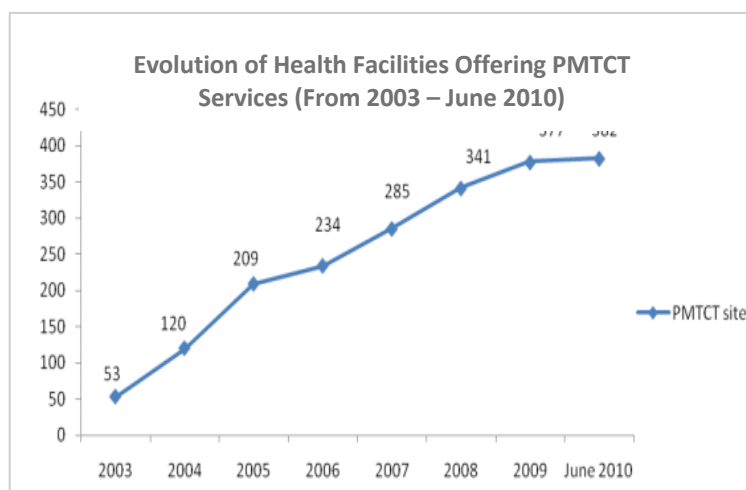
necessitate lifelong treatment.[52] Later studies showed that Option B in fact was more cost-effective in Rwanda for PMTCT.[52]

Under the official Option B protocol designed by the WHO, triple therapy for mothers is only continued through weaning and then stopped. When Rwanda implemented it, they chose to continue triple therapy for mothers indefinitely. Two years later, this strategy was officially recommended by the WHO (titled Option B+) as more effective than Option A.[49] Rwanda had already started the process of implementation before the WHO recommendation.

By 2009, all health centers offered ANC, which was and remains the main entry point for PMTCT care. The investment in the primary health care where PMTCT is integrated into ANC has allowed for the sustainment of national PMTCT services. However, to adequately provide PMTCT to expecting mothers, all health centers have needed ongoing capacity-building and infrastructure investment prior to and after starting PMTCT programs. National coverage for PMTCT has also been maintained by the introduction of ARV treatment initiation by nurses at the community level in 2009.[49] Although there was initial hesitation about risks to quality of care, research showed that high patient retention and positive health outcomes could be achieved with nurses offering this care.[53] In the context of PMTCT, this change in policy resulted in a significant increase in the number of providers able to offer full-spectrum PMTCT care nationwide.
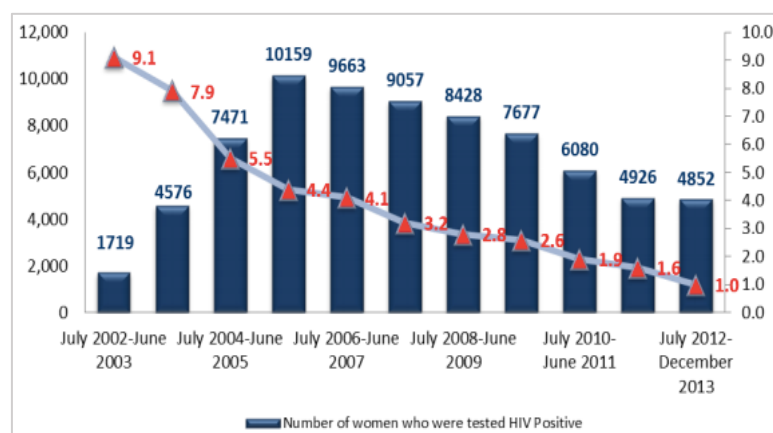
Figure 9: HIV Testing and HIV-Positive Status in Pregnant Women (Source: Rwanda Annual Health Statistics Booklet 2014)

In 2011, the First Lady of Rwanda further contributed to sustainment of the PMTCT program by launching a campaign to eliminate MTCT in Rwanda, further marking this issue as a national priority.[54] MTCT transmission in 2010 was 2.4 percent, and the elimination campaign aimed to reduce rates below 2 percent by 2015 – a goal that was accomplished.[14]

4.2.2 Antiretroviral Treatment for Children

EXPLORATION

Without treatment, more than half of HIV-positive infants will die by the age of 2.[55] Identifying children with HIV is essential to successful reduction in HIV-related mortality. In 2008 and 2009, 50 percent and 70 percent of health facilities in Rwanda were offering early infant diagnosis of HIV (EID), respectively. Yet only

28 percent of children born to HIV-positive mothers were receiving EID.[56] In response to this data, the MOH determined to improve the coverage of the EID program.

<u>PREPARATION</u>

The Ministry of Health organized the first National Symposium on Early Infant Diagnosis in 2009, gathering healthcare providers, policymakers, implementation partners and program managers to discuss gaps in the current EID program and path to improvement. [57] This conference assisted the MOH in mapping out specific problems, including poor integration with maternal and child health programs, delays in processing of HIV tests, and lack of follow-up with infant caregivers.[57]

<u>IMPLEMENTATION</u>

The Ministry of Health adopted specific changes in their EID and pediatric ART programs to address these identified gaps. To better integrate into general maternal and child health programs, the MOH added an indicator into the performance-based financing system for provider-initiated HIV testing for infants; changed the routine immunization schedule to include HIV-testing for exposed infants at 6 weeks, 9 months, and 18 months; and added HIV-testing as a standard component of work-up for at-risk children identified through tuberculosis and nutrition programs. To reduce the amount of time from collecting the testing sample to receiving the results, the MOH started a car pickup system in all 30 districts twice weekly and developed a program to deliver results to providers by SMS. To improve counselling to parents and increase follow-up, the annual training for providers of HIV care was adjusted to include training specifically on the testing and treatment of infants and the sensitization of parents.[57,58]

Between 2002 and 2013, the number of health facilities in Rwanda offering ART increased from four to 465.[59] The medications needed for infant ART are provided and distributed using one national supply chain. Patients are monitored using a national monitoring and evaluation system, with phone or home visits performed for those who miss appointments.[60]

Table 13: ART Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Reach	Decentralization of health systems including HIV, incorporation in PHC.	Health facilities offering ART increased from 4 in 2002 to 465 in 2013. [59]
Effectiveness	Improved counseling related to HIV testing, integration of EID into established health programs, and shortening of time from testing to results.	EID for infants born to HIV-positive mothers in 2011 was 72-94%. [57,59] In 2013, 60% of HIV-positive children ages 0-14 years were receiving ART. [59]
Feasibility	Use of technology and regular transport of samples by car to decrease time between EID testing and results.	Turnaround time from collection of sample to receipt of results by the provider decreased from 144 days to 20 days. [57]

For integration of EID into standard pediatric care, the MOH has adopted HIV-testing for exposed infants into the routine immunization schedule. The immunization cards were adapted to include coded information on the exposure of each child to HIV.[57]

Despite improvements in testing and universal access to ART, treatment of HIV-positive children remains limited. In 2013, only 60 percent of HIV-positive children ages 0-14 years were receiving ART, as compared to 95 percent of HIV-positive adults.[59] The disparities in treatment between these two groups requires further evaluation.

4.3 Measles

EXPLORATION, PREPARATION AND IMPLEMENTATION PRIOR TO 2000

The measles vaccine was introduced in Rwanda in 1980, and during the years prior to the genocide in 1994, national coverage of the vaccine ranged between 74 and 89 percent.[61] In 1995, just after the destruction of the health sector, measles, along with neonatal causes and lower respiratory infection, was one of the leading causes of death for children under-5.[5] The original introduction of the measles vaccine in Rwanda is outside the scope of this report, but between 2000 and 2015 the country adapted the implementation strategies to better serve the changing data on measles cases in the country.

SUSTAINMENT

Sixty nine to seventy four percent of children in Rwanda were vaccinated for measles from 2000-2002.[62] During this time, there were thousands of cases of measles annually nationwide.[63] Measles vaccination rates increased to 90 percent by 2003, and have remained steadily in the 90s since 2006.[62] Cases of measles decreased to hundreds annually by 2004, and only six cases in 2008.[63] The Ministry of Health set a goal to eliminate measles in Rwanda by 2020 – they would be the first country in Africa to do so.

With this goal of eliminating measles, Rwanda established a technical committee to consider roll-out of the measles-rubella (MR) combined vaccine in 2012. At that time, Gavi, the Vaccine Alliance, announced co-financing and WHO recommended all children receive a second dose of measles vaccine prior to age 5.[7] Evidence, recognition of the burden of disease of measles, and an opportunity for funding pushed implementers to prioritize upgrading the vaccine schedule to include the MR vaccine. In early 2013, after the plan and the funding were in place, the Ministry of Health launched a program to identify and vaccinate children from 9 months to 15 years with the MR vaccine in schools, community sites, transit vaccination posts in border districts, and health centers, overall targeting around 15 million children. From a household survey, regions with low coverage were identified and targeted. Roll-out of the MR vaccine occurred during the national Child and Adolescent Health Week, including concurrent administration of vitamin A and HPV vaccination.[7]

According to key informants, the largest challenge for measles vaccination is the risk of imported cases from other countries. With the flow of displaced persons into Rwanda, primarily from Burundi and the

Democratic Republic of the Congo, there is significant risk of measles outbreaks in unvaccinated persons. In 2010, of the 121 documented cases of measles nationwide, all cases were in districts bordering Burundi and the DRC or could be traced to index cases from one of those border districts.[64] Reflecting capacity to respond to emerging threats and use of surveillance data, to combat this, UNHCR, in coordination with the MOH, vaccinates all refugees for measles and polio before they enter camps and conducts routine vaccination campaigns in refugee camps (KI). Although UNHCR performs the vaccinations, all vaccines are acquired using national procurement processes and MOH supply chains.

Table 14: Measles Vaccination Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Acceptability	Community sensitization for the MR vaccine was carried out through media (TV, newspaper, and radio commercials); CHW outreach at community Umuganda meetings; and education of local teachers who then sensitized their students. [7]	Coverage with the MR vaccine estimated at 95% in 2015.[65]
Feasibility	Partnership between UNHCR and MOH, using UNHCR staff in refugee camps and MOH supply chain for refugee vaccination.	Regular response to new needs and cases possible through leveraging of existing platforms.
Effectiveness and Reach	Integrated into routine and new vaccines Developed response to refugees' influx.	Measles vaccine coverage was maintained above 80% from 2003 to 2009.[64] In 2010, there was a vaccine coverage rate of 95% and 121 identified cases of measles nationwide. [64,66] No extended outbreaks identified despite influx of new unvaccinated populations.
Equity	Refugee populations receive additional measles vaccination to prevent epidemics.[64]	Coverage is high regardless of wealth and location. Coverage of refugee populations also reported as high.

Measles Mortality and Intervention Coverage in Rwanda
99% decline 2000-2015
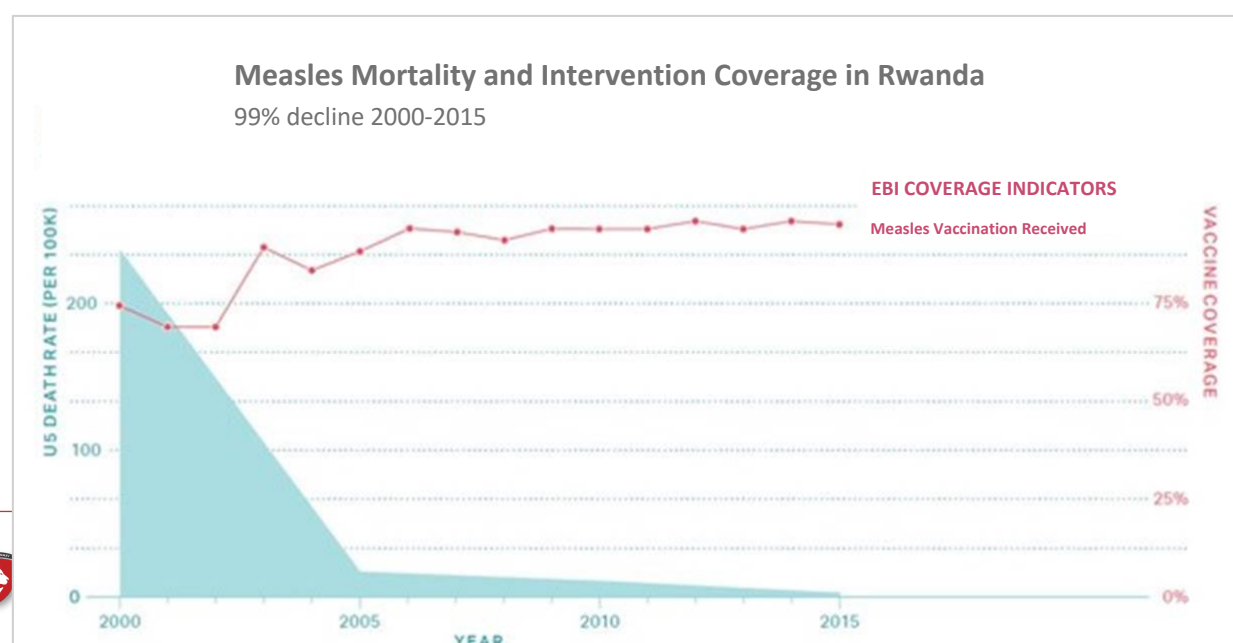
Figure 10: Measles Mortality and Intervention Coverage in Rwanda, 2000-2015 (Source: IHME Global Burden of Disease 2016 and WHO/UNICEF vaccine coverage estimates for 1980-2017)

4.4   Other Vaccine Preventable Diseases

Rwanda has used similar strategies to maintain high vaccine coverage for multiple other diseases. Eighty seven to ninety nine percent of children have received three doses of diphtheria-pertussis-tetanus vaccination between the years 2000 and 2015.[65] There have been no documented cases of diphtheria or pertussis in Rwanda since 2001.[67] Although there was a peak incidence of tetanus in 2003 with 93 cases nationally, incidence has been near or at zero since 2005.[67] Polio vaccination coverage has varied between 84 and 99 percent from 2000 to 2015, and Rwanda has had zero documented cases of polio during that time.[65,67] With high vaccination coverage and low incidence, none of these diseases had an impact on child under-5 mortality between the years of 2000 and 2015.

4.4.1   Haemophilus influenzae type B (Hib) Vaccine

The decision to implement the Hib vaccine had two major motivating factors: 1) Gavi, founded in 2000, put the Hib vaccine at the "top of its priority list", making it one of the first opportunities for Gavi support of a new vaccine rollout in Rwanda, and 2) there was a substantial burden of pneumonia and meningitis due to Haemophilus influenza.[68] This, as in many other cases of EBI implementation in Rwanda, demonstrated an overlapping opportunity for international support and national priorities and needs. Prior to rollout, it was necessary to assess the capacity and training needed to introduce the new antigen, to make sure the new antigen was aligned with the current vaccine schedule and that M&E and data collection tools were in place, and to ensure the sustainability of funds for the vaccine. The WHO country office supported the rollout with technical assistance. The EPI program introduced Hib as part of the pentavalent vaccine, which also included DPT and hepatitis B, in 2002.[8] Although the concept of introducing vaccines was still fairly new in Rwanda at the time, one KI stated there was high acceptability because of the positive experience of the measles vaccine, negative experiences with vaccine-preventable diseases, immediately perceivable positive results, and implicit trust in the MOH and the Government of Rwanda. Regarding equity, the same KI indicated that equity of coverage for this vaccine was not a problem because vaccines are provided free of charge and there are health centers in each sector that are capable of immunizing children, addressing the issues of financial and geographic access. Coverage of complete Hib vaccination (as part of the pentavalent vaccine) has consistently remained high (above 85 percent nationally, according to WHO, UNICEF, and DHS data) since 2005.[2,65] As with all other vaccines, financial sustainability of the vaccine is a

concern, although there are opportunities to offset costs, such as reducing vaccination support for people in the highest income group (*Ubudehe 4*). (KI)

4.5   Severe Acute Malnutrition

EXPLORATION

In 2000, 6.8 percent of children under-5 in Rwanda were acutely malnourished.[1] According to the 2003 Ministry of Health annual report, severe acute malnutrition was the fourth most common cause of death for children ages 0-1 year and the second most common cause of death for children 1-14 years.[69] Citing this data, the Rwandan Ministry of Health identified acute malnutrition as a priority for the country in their 2007 National Nutrition Policy. While Rwanda has led the region in reducing severe acute malnutrition, it has lagged in efforts to reduce chronic malnutrition and stunting. Given the focus on U5M, we examine the severe acute malnutrition results, but the strategies also target chronic malnutrition.

PREPARATION

The Government of Rwanda produced a series of national policies expressing their commitment to reducing malnutrition both severe acute malnutrition and chronic. The President's Initiative to Eliminate Malnutrition (2009), National Nutrition Summits (2009 and 2011), National Protocol for Management of Malnutrition (2009) and the National multisector Plan to Eliminate Malnutrition (2010), brought together multiple ministries – including the Ministries of Health, Finance, Agriculture, Education and Local Government – to outline national strategies.[70,71] These were then adapted for local contexts in District Plans to Eliminate Malnutrition (2011).[70] For acute malnutrition, these plans focused on early identification using CHWs.[70]

IMPLEMENTATION

Following the President's Initiative to Eliminate Malnutrition in 2009, 30,000 CHWs were trained in identification of and monitoring for malnutrition in children under-5 using the community health program's train-the-trainer model.[70] Documents and screening tools for the community based nutrition program (CBNP) were developed and distributed to all CHWs nationwide. Using weight-for-age scales and mid-upper-arm circumference (MUAC), CHWs monitor all children in their catchment area for malnutrition monthly. If children do not appear at the meeting for the monthly measurements, CHWs will go to their homes. Parents of children deemed at risk based on their measurements are then invited to "kitchen demonstration activities," where families bring in food and cook together to learn about nutrition from the CHW (KI). Those children that are deemed malnourished are given ready-to-use therapeutic foods and referred to health facilities for treatment.[71]

Table 15: Severe Acute Malnutrition Implementation Strategies and Outcomes

	Implementation Strategies	Implementation Outcomes
Reach	Utilization of existing community health workers program.	82% of children under-5 were screened for malnutrition in 2014. [72]

Effectiveness		Wasting (low weight-for-height and therefore a marker for acute malnutrition) decreased from 6.8% of children under-5 in 2000, to 5% in 2005, 3% in 2010, and 2% in 2015. [2] Note that similar success was not seen in markers of more chronic malnutrition including stunting.

SUSTAINMENT

The Ministry of Health has established a system to tracks community screening and cases of malnutrition using existing CHW M&E systems, including Rapid SMS. Significant challenges remain, particularly in addressing chronic malnutrition. Some potential causes identified have included a lack of knowledge about nutrition among CHWs, lack of supervision within the CHW program, and inefficient supply chain for severe malnutrition treatments.[70,71,73]

To better address chronic malnutrition, the MOH started a new nutrition program to provide for free nutritious porridge with all needed micronutrient in the daily servings, to children aged 6 months to 2 years. The MOH provide it for free to all children from category one of Ubudehe (highest level of needs index) using the national budget and by encouraging families from Ubudehe two, three, and four to buy it and serve it to their children. The factory producing the porridge has been built with funding through the Ministry of Finance and the supply chain to bring the product in all districts has been created with the support of donors. The national campaign by the MOH and its affiliated institution is ongoing.
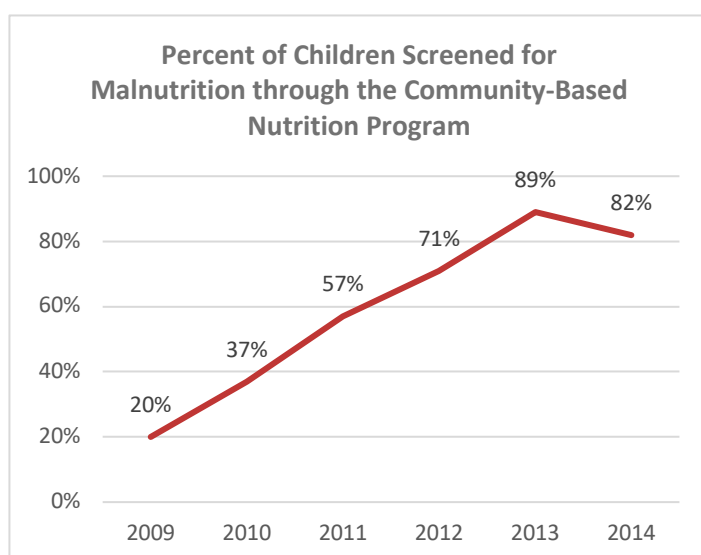
Figure 11: Percent of Children Screened for Malnutrition through the Community-Based Nutrition Program (Source: Rwanda Annual Health Statistics Booklet, 2014)

4.6 Neonatal Mortality

Despite the national commitment to reducing childhood mortality from 2000 to 2010 and increase in facility-based deliveries (FBDs), there was less focus on neonatal deaths during that time. Some interventions had already been a focus including increased FBD, increasing ANC, and reducing financial and geographic barriers to access for maternal care. As noted above, the decrease in neonatal mortality has been slower in Rwanda than under 5 mortality, similar to trends across the region.[5] The Global Burden of Disease data showed that neonatal deaths had increased from 27 percent of all child under-5 deaths in 2000 to 31 percent in 2010.[5,15] While deaths in children ages 1-59 months decreased from 149 per 1,000 live births in 2000 to 97 in 2010, deaths in children under 1 month of age decreased only from 42 to 40 during the same time period.[15] [d] According to former Rwandan Minister of Health, Dr. Agnes Binagwaho, "we always knew in a sense" that neonatal mortality rates were not improving as quickly as infant and child mortality rates. The release of the 2010 study "put a number behind a situation we intuitively felt," making neonatal mortality a priority for the Ministry of Health. This occurred despite increases in some interventions associated with reduced neonatal mortality including facility-based deliveries and antenatal care.

To better understand the causes of neonatal deaths in Rwanda despite increased FBD, the Ministry of Health started weekly neonatal death audits in 40 public and faith-based health facilities in 2012.[74] Using a standardized questionnaire, all neonatal deaths in these facilities were reported to the Ministry of Health in Kigali.[74] Causes of death included birth asphyxia, hypothermia, respiratory distress (particularly in premature infants) as well as a growing proportion due to congenital abnormalities.

Using the neonatal death audits, review of the existing evidence on reducing neonatal mortality and input from the TWG, the MOH chose EBIs based on specific causes of death affecting newborns, the two most common being asphyxia and complications due to prematurity.[51,72,75,76] In collaboration with implementing partners, the Rwandan MOH revised and adopted major maternal and neonatal health interventions including skin-to-skin and immediate warming, KMC for low birth weight and premature infants, Helping Babies Breathe, and active management of the third stage of labor (AMSTL).[16] Because approximately 75 percent of neonates who died were hypothermic when admitted, the MOH started with providing incubators for facilities, increasing focus on skin-to-skin.[75] They also revised EmONC guidelines (basic and comprehensive) and trainings and national neonatal clinical treatment guidelines, and integrated these interventions into one maternal-child health services package.[16,17] Each portion of this package was updated to be relevant to Rwanda, adapted to remove repetitive information from other trainings, and translated into Kinyarwanda. According to key informants, each of these interventions was decided upon based on health facility data on causes of morbidity and mortality and priority areas identified by the MOH and existing EBIs.

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[d] DHS data from the same time period shows a drop from 44 per 1000 live births in 2000 to 27 per 1000 live births in 2010. However, key informants cited the GBD data as the trigger for a larger focus on neonatal mortality within the Ministry of Health.

4.6.1 Antenatal Care

Nearly all women in Rwanda receive some ANC from a skilled provider, regardless of age, province, socioeconomic status, or level of education. Rates of ANC by a skilled provider have increased from 92 percent of women in 2000 to 99 percent in 2015.[1,2] However, far fewer women receive the 4+ visits recommended by the WHO. In 2015, only 43.9 percent of pregnant women had four or more ANC visits.[2]

4.6.2 Facility-Based Delivery

With the introduction of maternal-health focused ASMs in 2003, the Rwandan MOH trained local traditional birth attendants to advise women to deliver in health facilities. Over the next 15 years, the rates of facility-based delivery and delivery with a trained birth attendant increased dramatically (Figures 11 and 12), with ongoing increase between 2010 and 2015, the period of increased focus on neonatal mortality.

Figure 12: Facility-Based Delivery (Source: Rwanda DHS 1992, 2000, 2005, 2010 and 2015)

4.6.3 Kangaroo Mother Care (KMC)

The MOH started to establish KMC for low birth weight and premature infants in health facilities with the new neonatal protocols in 2012. However, dedicating entire rooms to both neonatal intensive care and to KMC proved difficult, if not impossible for health facilities. KMC was started to be implemented in hospitals as space was made available. According to key informants, sensitization of mothers also was difficult due to cultural norms of carrying babies on women's back and other duties preventing consistent KMC for the total recommended time. However, CHWs continue sensitization and education of mothers in KMC when they return home from the health facility.

Figure 13: Births with a Trained Attendant (Source: Rwanda DHS 1992, 2000, 2005, 2010, and 2015)

4.6.4 Training of Health Care Providers

Training in the maternal and neonatal care package of services was done through the train-the-trainers model. Although local training of service providers was managed by implementing partners in their respective districts, all used the same national training guidelines across the country.

4.6.5 Immediate Breastfeeding

Health providers teach post-partum mothers how to breastfeed while they are still in the health facility. One key informant related that because over 90 percent of women now deliver in health facilities, these women also are sensitized to the benefits of exclusive breastfeeding and are taught breastfeeding techniques. According to the Rwanda DHS, the number of children breastfed within one hour of birth increased from 41 percent in 2005 to 71 percent in 2010 and 81 percent in 2015.[2,9,77]

4.6.6 Active Management of Labor: Partograph Use

Partographs are a component of reducing intrapartum deaths. Blank partographs are available at all health facilities, and the use of partographs has been added as an indicator for performance-based financing. However while they used in approximately 84 percent of deliveries in health care facilities in Rwanda, although only 8 percent of those are filled in completely.[78]

4.6.7 Prevention and Management of Hypothermia

According to a 2012 quality of care study, 100 percent of children born in health facilities in Rwanda are immediately dried with a towel. Approximately 50 percent of those infants are then placed skin-to-skin with mother and/or covered with a dry towel or blanket, representing an area for improvement.[78]

Table 16: Neonatal Mortality Implementation Strategies and Outcomes

	Implementation Strategy	Implementation Outcomes
Reach	Expansion basic or comprehensive EmONC at all hospitals. Integration of post-partum visits through ASMs.	Rates of C-section increased from 2.1% of deliveries in 2000, to 2.9% in 2005, 7.1% in 2010 and 13.0% in 2015.[1,2,9,77] Women having a post-partum checkup within the first 2 days following delivery increased from 2.9% in 2000 to 43% in 2015.[1,2]
Fidelity	National policies and training do not necessarily equate to reliable quality of care.	Partographs, while available were not widely used completely.[79] Only 7% of women getting AMSTL received all components.[79]
Equity	Training of health center nurses obstetric and neonatal care to better reach rural areas.	There is no difference in percentage of women receiving ANC between rural and urban populations.[2] Women living in urban areas are still more likely to deliver in a health facility than those living in rural areas (97% vs 89% in 2015).[2]

SUSTAINMENT

While there has been success in implementing a number of these EBIs, ongoing work is needed to continue to work to drop the neonatal morality and addressing the rising burden related to prematurity, congenital heart disease and low birth weight (KI). An identified need is for ongoing evaluation and improvement in the quality of care received through these established interventions. For example, in one measurement of quality although 97 percent of women getting AMSTL receive oxytocin, only 48 percent of those women receive it within the recommended 3-minute window. Only seven percent receive all components of AMSTL as recommended in the national guidelines.[79]

Further improvement in neonatal care will also require ongoing trainings and supportive supervision for non-neonatal care specialists. Although small programs have shown training nurses in neonatology leads to improvements in neonatal mortality, the implementation of these interventions are typically constrained by the need for frequent training due to limited staff availability and high staff turnover.[80] Although knowledge is high immediately following trainings on newborn care topics, this knowledge decreases with time, requiring frequent refresher trainings for providers.[78,81] The majority of neonatal deaths are now related to prematurity and low birth weight, Further reductions in neonatal mortality will therefore require significantly more complex interventions and investments. The country is starting to address these issues through expansion of neonatal ICUs. Work is also ongoing to address the needs for more advanced neonatal care at the district hospital level including redesign of space to improve infection control.

In addition, in 2013, the MOH with its partner, IMB, developed an intervention designed to reduce neonatal mortality through improving quality, competency and systems of care (All Babies Count (ABC)) in two districts. This model includes initial provision of essential equipment and materials, establishment of learning collaboratives inclusive of the entire district health system (CHW, health centers, and the district hospital) and regular on-site clinical mentorship for continuous improvement in EBIs known to reduce neonatal mortality in the antenatal. Intrapartum and in post-partum neonatal care.[82] Over 18 months, several key indicators for neonatal care improved in these districts, including immediate skin-to-skin warming (19 percent to 87 percent of newborns), newborns checked for danger signs within 24 hours of birth (47 percent to 98 percent) and antenatal corticosteroids for women with preterm labor (26 percent to 75 percent).[83] This model is now expanding to additional districts.

5 Cross-Cutting Contextual Factors Facilitating U5M Reduction

During the desk and interview process we recognized that there were a large number of cross-cutting contextual factors in Rwanda critical to the EBI implementation and associated drop in U5M. Many of these were the result of specific policy and strategy interventions enacted as broader health system strengthening work as well as some which were integral to the goals of dropping U5M. In addition, a number of organizational culture and practices at the national and sub national levels were also deliberate interventions which were found to be important facilitators of EBI implementation success. While not technically "EBIs", these policies and organizational level interventions were critical in creating the environment and facilitating contextual factors that contributed to the country's success directly or through creation of an enabling environment and context. These contextual factors are described below.

5.1 Culture and Governance

5.1.1 Leadership and Governance at All Levels and Common Vision

A recurring theme throughout was the strong, visible, and constant leadership and governance. While this was often led and set nationally, many KIs reported that the responsibility, accountability, and leadership cascaded to the ministry, sub-national, local and individual levels. This resulted in local authority and ownership of the results of interventions and willingness to continue to adapt to challenges. This was often facilitated by key policies and strategies such as the local cross-sectoral target setting at all levels, from mayoral districts up to ministries, with accountability up to the national level (see below section on accountability).

One example of the coordinated vision and good governance from the national level with multi-level input was the development in 2000 of Vision 2020, which set targets for development goals for Rwanda across multiple sectors. They represented bold goals for addressing multiple areas including health, poverty, education, and development and served as a guide for Rwanda toward a unified vision of becoming a middle-income country by 2020. The health aspects included:

- Human resource development and a knowledge-based economy; and
- Reducing U5MR, including through family planning, malaria control, and reduction of HIV/AIDS[84]

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This governance was later reflected in the data-driven target changes to Vision 2020 reflecting achievement of a number of the goals and ongoing commitment to higher results and achieve "more with less" (see below section on data use).

The work also prioritized increasing governance effectiveness, which was reflected in improvement across almost every World Bank governance indicator rating.[85]

Rwanda improved significantly relative to its peers across a number of governance indicators
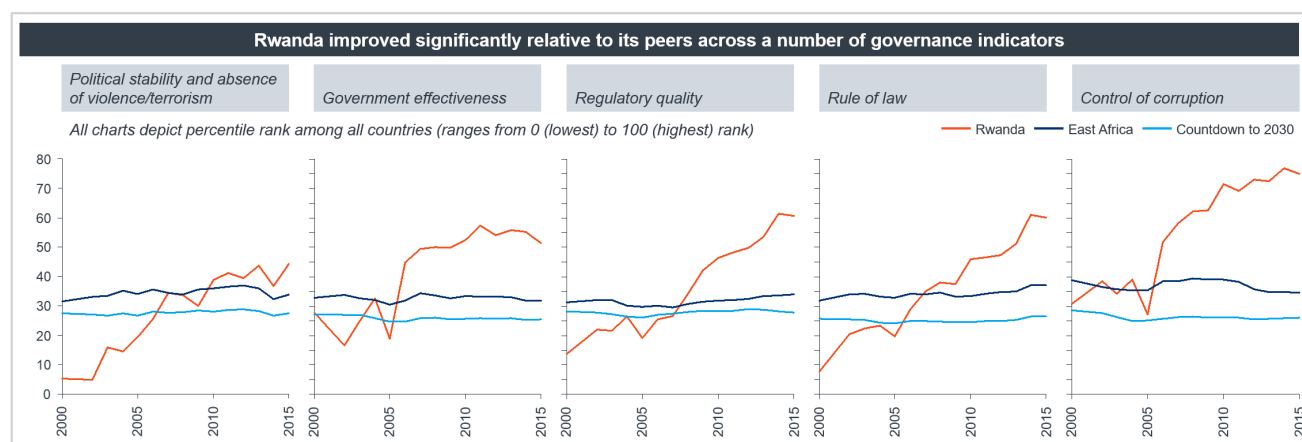
Figure 15: Governance Indicators for Rwanda (Source: World Governance Indicators, The World Bank Group)

Leadership was identified as a critical contextual facilitator from the national level down. For example, one Minister of Health was described as a "stellar leader [who is] very results driven but delegates authority and responsibility with accountability."

Leadership also manifested in a number of key organizational culture and prioritization efforts including: **accountability, delegation, data use, coordination, community engagement, and willingness to rapidly integrate new initiatives into national strategies to reduce U5M.**

5.1.2 Accountability

This was a major theme with policies set nationally, but also is seen through each level down to the local facility and community. This often built off and strengthened the data utilization and evidence-based culture which were explicitly developed, as detailed below.

At the national level, steps to ensure accountability included:

- Policies designed in a participatory process, that set out a single vision that, revised based on results and data.
- Development of the imihigo system. Imihigo practice is a home-grown solution based on pre-colonial culture. It is the plural of umuhigo, which means to vow to deliver. Imihigo also includes the concept of setting goals to be achieved within an agreed period of time with specific guiding principles and the determination to overcome any possible obstacle and compete among one another to be the best. With local priority and goal-setting, to which districts are held accountable by civil society and the government. Every year, ministers and all district mayors signed the imihigo performance contracts with the President of the Republic. These contracts include up to 100 indicators, including 15 which are health-related (e.g. modern contraceptive prevalence, ITN coverage rates, and enrollment in the community national health insurance (CBHI, Mutuelle de Santé). Imihigo was designed to not only increase accountability but also to encourage competition between districts to perform better to meet agreed upon targets. Multiple KIs noted the success of this strategy to include health sector performance as a mutually owned target, under the ownership of local leaders rather than just the MOH. Key implementation strategies included:
    - Sensitization of local leaders;
    - Clear value from national level with public reporting directly to the president; and
    - Inclusion of health indicators which increased cross-sectoral efforts to increase use of key interventions, such as facility-based delivery.
- Implementation of Performance Based Financing for health worker accountability on quantity and quality of services (facility-based and CHW).[86]
- Strong, visible and sustained commitment to emerging health issues.
    - All maternal deaths are reported the MOH. This commitment therefore goes beyond making inspiring statements but is associated with a sense of accountability noted by several interviewees.
    - The president mandated a response to malnutrition based on numbers of children seen with severe acute malnutrition.

This accountability was also seen at the MOH level through use of data to monitor and highlight areas for improvement (see below section on data use). Examples included:
- Regular review of data at MOH and division specific meetings
- Institution of maternal and, later, neonatal death audits
Use of data to adapt strategies and interventions as noted in the specific EBI sections below

KIs reported that these interventions also resulted in accountability at the local level, particularly through the imihigo as well as the performance-based financing, which were recognized by district level KIs as directly linking care delivery and quality and meeting coverage goals to funding and compensation. This has also supported decentralization, described below, by increasing the accountability at the district and facility levels.[87]

5.1.3   Financial Commitment to Health

Over the last fifteen years, Rwanda has shown domestic commitment to health care coupled with a steady increase in both internal and external funding. Rwanda's total expenditure on health increased from $73

million current USD in 2000 to $595 million current USD in 2014. This has corresponded with an increase in total health expenditure per capita of $43 current USD per person. The government of Rwanda's contribution to total health expenditure has also increased in absolute terms (from $29 million to $227 million current USD), although contribution as percent of total health expenditure has fluctuated and is currently at similar levels to 2000 (39 percent in 2000; peak at 52 percent in 2002, 38 percent now;). General government health expenditure as a percentage of general government expenditure has also fluctuated between 9 percent (2000) and 23 percent (2006), but has leveled out at 10 percent from 2010-2014.[88]

5.2   Coordination, Collaboration and Communication

This leadership was also reflected in a strong focus and mandate for coordination inside the health sector, between ministries and importantly between MOH, donors and partners and local implementers of the health sector.
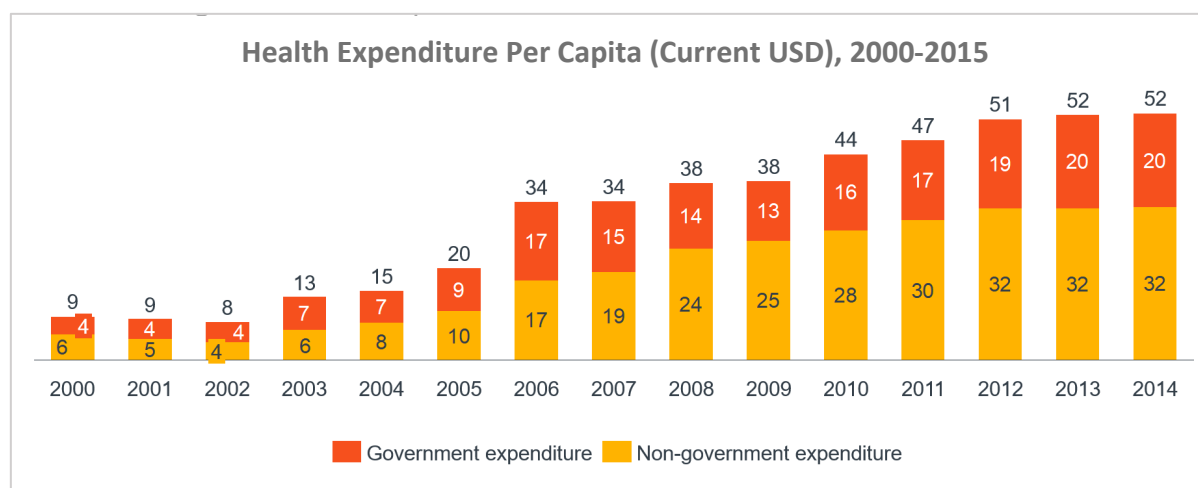
Figure 16: Health Expenditure per Capita in Rwanda 2000-2015 (Source: WHO Global Health Expenditure Database)

5.2.1   Health Sector Coordination

Inside the MOH, there is a weekly senior management meeting to review and draft laws, policies, programs, plans and reports by the department. These meetings ensure the contribution and a common understating of all national leaders within the health sector. The meeting is chaired by the Minister of Health, and the leadership at the MOH and affiliate institutions such as the Rwanda Biomedical Center (RBC) attend. Every month, there is also a general senior management meeting, where all draft laws, policies, programs, plans and reports are adopted internally before being send out. The meeting attendees are comprised of those at the senior management meetings plus all heads of division at MOH and RBC and the directors of public hospitals.

5.2.2   Donor Coordination

Rwanda has been committed to ensuring coordination between national NGOs, donors, partners, local government, and Ministries, including the MOH, toward achieving the country-defined goals and targets.

One KI involved in the work in the 1990s reported that this started early in the process of rebuilding the health system, identifying priorities even as the government was being established. This coordination was achieved through development of clear goals, strategies, and targets, with close consultation from partners on technical working groups. In the beginning, this was a change: the "major challenge was getting partners to support - if [the] partner does not want, [the Government of Rwanda] would say no and not take the money". This took about three years to put into place but was backed up by political commitment. "We mean business, we will do it." As one partner noted, there was a culture of "we, [Rwanda], are in charge and we will tell you what to do...this is a Rwandan program." The strong ownership and willingness and ability to determine the strategy and implementation was identified as unusual. This, using the common vision to ensure coordination between donors and implementing partners, was identified as critical and, from one partner who had worked in multiple other countries in SSA, not seen in other countries in the region.

This work to engage partners to ensure alignment with the government's legislation, policies, and strategies and to coordinate included a number of key strategies:

1. Lead by the Ministry of Finance and Economic Planning (MINECOFIN), a planning group of government representatives and donors met quarterly to discuss aid coordination. They assessed the Common Performance Assessment Framework (CPAF) of each sector and the Donors Performance Assessment Framework (DPAF) to assess aid effectiveness. These frameworks had been jointly created. The DPAF reviews the performance of bilateral and multilateral donors against agreed upon indicators of quality and quantity of development assistance to Rwanda. This overarching government planning and monitoring framework by MINECOFIN overruled health sector-specific frameworks.

2. Donors who directly supported the health sector were permitted to attend the entire budget review process, which kept key donors informed and brought into the process and added valuable input while not giving away too much influence to donors with limited objectives/agenda. This strategy led to funding being used to not only to address disease-specific programs, but also to contribute to horizontal primary care infrastructure and less duplication of efforts.[89] For example, when pneumococcal vaccine was implemented, the coordinated work of stakeholders to strengthen the vaccine cold chain and supply chains facilitated rapid scale-up of other vaccines in the future.[7]

3. The Joint Health Sector Reviews (JHSR) were organized twice a year. The Minister of Health co-chaired the review with a lead donor in the health sector. The forum brings together ministry members, academics, hospital directors and other partners to represent the national and international civil society working in the health sector. One of the JHSR meetings served as a self-assessment of the health sector, where the group critically examines the achievements and performance over the last year according to targets and commitments. The second meeting was forward-looking, focusing on strategic priorities with policy recommendations for the coming year. The JHSR reports were distributed within the health sector and to MINECOFIN.

4. The MOH also leveraged the technical expertise of implementing partners and donors, to further inform and drive uptake of EBIs. One KI who had run one of the partner implementing organization's work noted the ability of the MOH to use the technical expertise of the partners widely through technical working groups (TWG) and through frequent meetings, allowing the partners to provide important input to the MOH-led decisions. This also resulted in rapid expansion of new initiatives such as PMTCT Option B+, with all partners engaged in and aware of the change to more effective HIV prevention, with Rwanda being one of the first LICs to implement.

5.2.3 Cross-Sectoral Coordination and Collaboration between Ministries

This culture and policy of collaboration and coordination was also seen between ministries. There are existing working groups which meet regularly to develop and align cross-sectoral policies and plans to propose at the national level. Ministries are organized into several clusters to enhance collaboration around cross-sectoral priorities. One such cluster was the Social Cluster, which comprises the Ministries of Health, Education, and Gender. These ministries work together to address issues which require input and coordination between them, such as gender-based violence and teenage pregnancies. The culture is one of collaboration: it is "not possible" for ministries to not cooperate. As one KI noted, "When they say it is a high priority for [the] country…everyone is accountable."

For example, when determining how to roll out pneumococcal vaccine, there had to be close coordination between the MOH and Ministry of Finance, who had to support the work rather than simply relying on donor funds. Another KI described the collaboration between the MOH and Ministry of Education as important in achieving coverage for vaccinations through school-based immunization programs. This is also represented in technical working groups inside the health sector designed to address national priority health areas (e.g. ICT, Malaria, HIV, TB, maternal and child health (MCH)).

5.2.4 Communication

The work to strengthen communication both during policy setting and during health care delivery was also identified as an important factor in facilitating EBI implementation and impact. This included building infrastructure with a commitment to technology at a national scale and increasing communication between ministries. All draft policies and draft laws initiated by a ministry member of the Social Cluster are presented for review and approval by the Permanent Secretaries of the ministries in the cluster. After review, the draft is sent to the Prime Minister. Communication between donors, partners, and the MOH is supported by the donor coordination strategies detailed above.

At the clinical level, communication was also prioritized to ensure more effective care. Resources were allocated to establish and support the referral system, including ambulances, and to increase coverage of the cellular network and internet to ensure systemic capacity to use phones or emails for communication. This has created strong communication channels both between health centers and hospitals and between health facilities and community health workers (CHWs).

5.2.5 Community Engagement

Related to communication, an explicit commitment to ensuring engagement of the community in all steps of EBI implementation was widely described by KIs. This included involving the community in input into selected interventions and very actively as new EBIs were rolled out. Examples noted in the specific EBI sections include vaccinations, iCCM, and HIV-related interventions. This work was done through close linkage with civil society and leveraging the CHW system to strengthen knowledge and education to drive acceptance of new or changed interventions.

5.3   Health System Design

5.3.1 Decentralization of the Health System

Health interventions are led by the national policy but implemented through a decentralized structure, which increased local ownership over health challenges.[87] In the early 2000s, Rwanda reorganized its administrative units into 30 administrative districts in 5 provinces. Prior to this, there were 106 districts and 12 provinces with one hospital at times serving the population of several districts and health districts still centered around hospitals and separate from administrative districts. Reflecting a willingness to reflect and adapt, in 2006, Rwanda underwent a further re-districting and territorial reform process.[77,90] Roles and responsibilities were redefined and health districts were incorporated into administrative districts under authority of the mayor (the elected head of the district). The MOH is responsible for supervision and data-driven monitoring and evaluation. This has increased ownership, collaboration and coordination at the local level. To further support decentralized authority and accountability, national-level central staff were reduced with some distribution among districts.[90] In 2008, Rwanda granted full autonomy to the districts for health decisions, including the right to hire and fire health workers, which is a fairly unique reform - few governments in sub-Saharan Africa have done this.[91] To ensure equity in geographic distribution of highly trained professionals, there is an exception to this local autonomous hiring policy for the MOH to hire nurses A1, nurses A0, and doctors for health facilities in rural areas with scarce human resources; however districts can fire these employees for lack of performance without consulting the central MOH. The autonomy of district was initially a challenge according to one KI, due to the disconnect between central and district levels, but successful decentralization was supported by the accountability initiatives described above. This decentralization was identified by a number of KIs as critical to the ability to rapidly and equitably implement the EBIs associated with reducing U5M and sustainability of the gains. This was supported by the accompanying decentralization of **accountability, data collection and use (through the monitoring and evaluation system), and leadership.**

5.3.2 Community Health Worker Program

5.3.2.1 Establishment of a CHW system

In 1995, Rwanda responded to a severe shortage of doctors and midwives by launching its community health worker (CHW) program. Today, there is a binome of two CHWs, one male and one female, in each village tasked with general health, including children under-5. They are responsible for the 100-150 households in their village. In 2003, an Animatrice de Santé Maternelle (ASM) – a CHW dedicated to maternal health – was added to each village. These ASMs were originally recruited from the existing

traditional birth attendants fulfilling a literacy requirement and receiving training on the importance of facility-based antenatal care and delivery for maternal health. Between its inception in 1995 and 2005, the number of CHWs in Rwanda increased from 12,000 to approximately 45,000.[92] CHWs are elected in every village by the community members, with requirements related to age and literacy. The literacy requirement was established to allow for regular reports and monitoring and evaluation of CHW activities. CHWs are trained in their relevant community health activities, but group trainings and refresher trainings are given based on both needs and available funding. Training follows a cascading, train-the-trainer model, although the frequency and format of trainings and refresher trainings. They are provided with flow charts and handbooks to assist them in their work. CHWs are supervised locally by cell coordinators, and then by in-charges at the health center level. In-charges at the health centers are supervised by an in-charge at the district hospital, who have to visit all their health center in-charges once a month.

5.3.2.2   Structure of the CHW Program
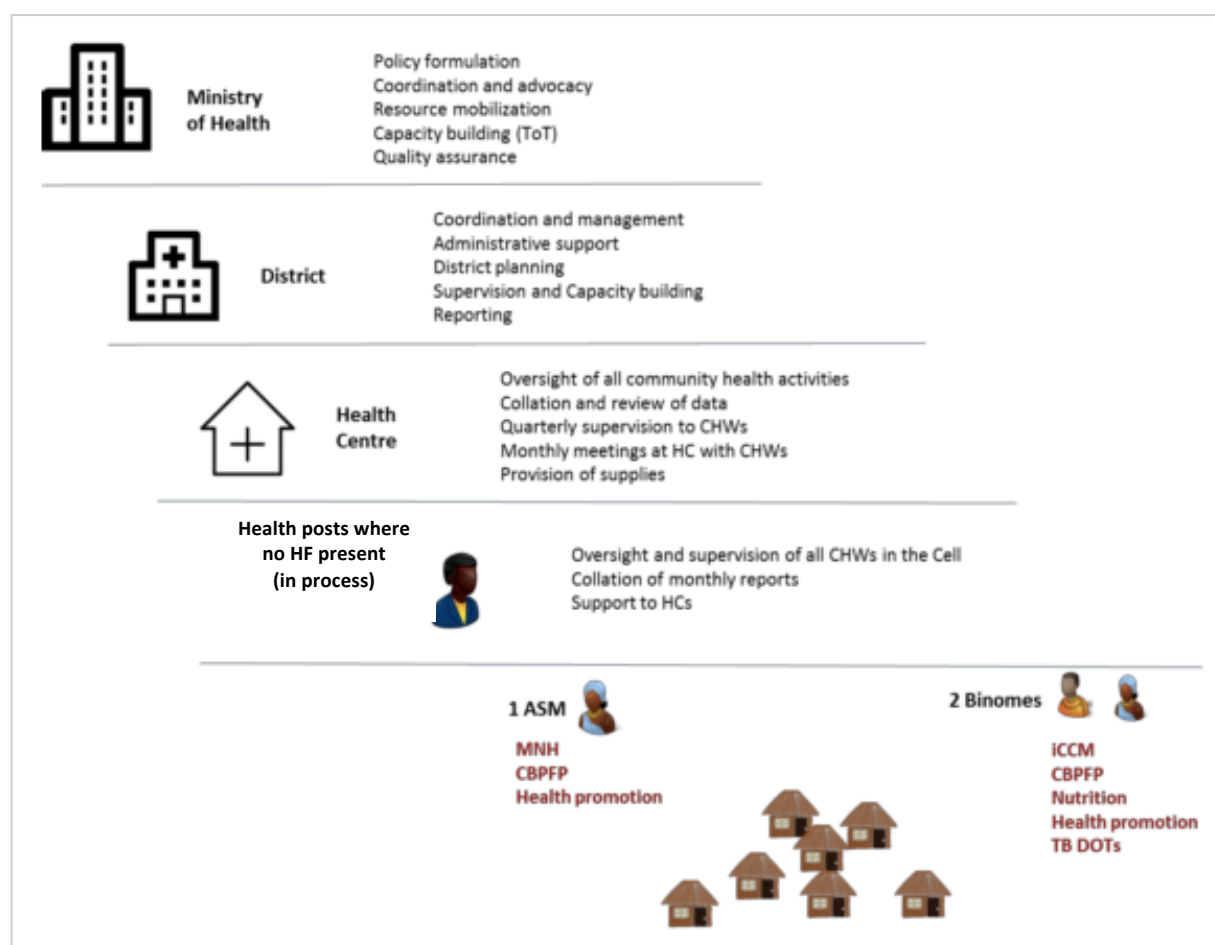
Figure 17: Rwandan Health System Structure (Adapted from Liverpool School of Tropical Medicine)

The CHWs report 41 indicators monthly to the local health center for local and national reporting, monitoring and evaluation system. When dropping off the monthly reports to the health center, the CHW also picks up medications and supplies, capitalizing on existing supply chains to local health facilities.[29]

CHWs in Rwanda are unpaid volunteers, although in 2005, they were placed into formal cooperatives, run by the CHWs, with financing through a CHW performance-based financing scheme.

5.3.2.3 Chronology of the CHW Program

Today, 45,000 community health workers provide a high-coverage, low-cost means of providing health care to every village in the country. CHWs are in all thirty districts of the country, enabling increased geographic access to basic levels of primary healthcare and forging a foundation for the implementation strategies for specific EBIs described below which are associated with the reduction of U5M.
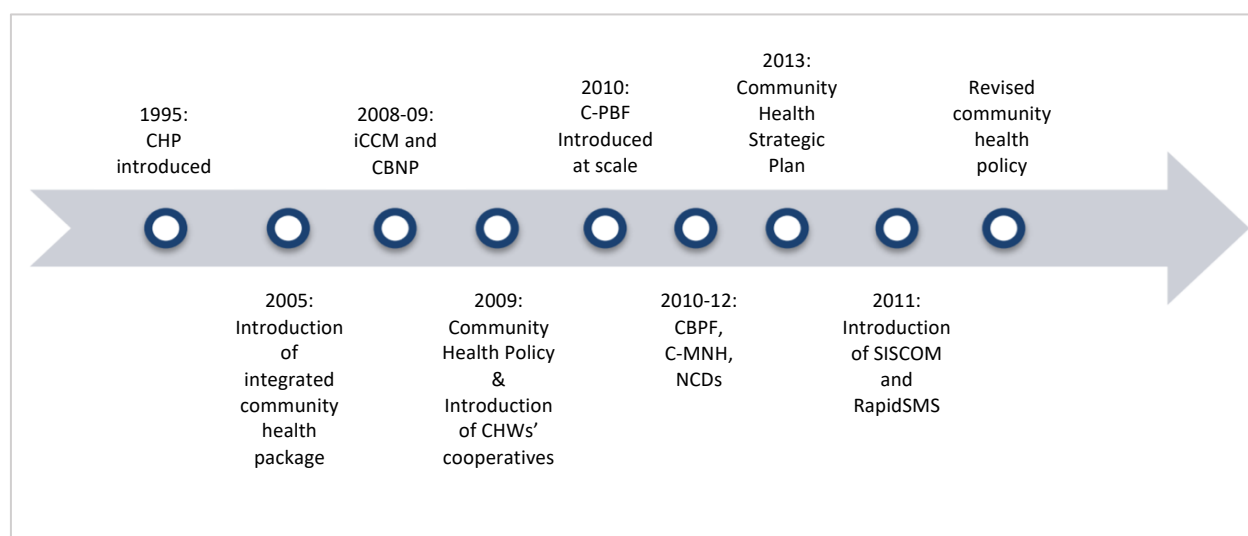
Figure 18: Timeline of Rwandan CHW Program (Source: Liverpool School of Tropical Medicine)

The primary motivating factors for CHWs are desire to help their communities, access to training and knowledge, and the respect they have from their communities.[30,73,93] However, maintaining motivation, including levels of financial compensation, has been identified as a major barrier to the sustainability of the CHW program since its outset. The cooperatives have proven to provide CHWs with little financial benefit, due to lack of training in management and finances.[30,73,93] Considering the consistently increasing responsibilities of the CHWs, dropout also poses a significant risk to long-term sustainability. Due to these concerns, the Rwandan MOH is requesting that cooperatives recruit accountants and is currently undergoing an external evaluation of the CHW model and how to improve it in the context of post-MDG priorities.

5.3.3 Community-Based Health Insurance (CBHI)
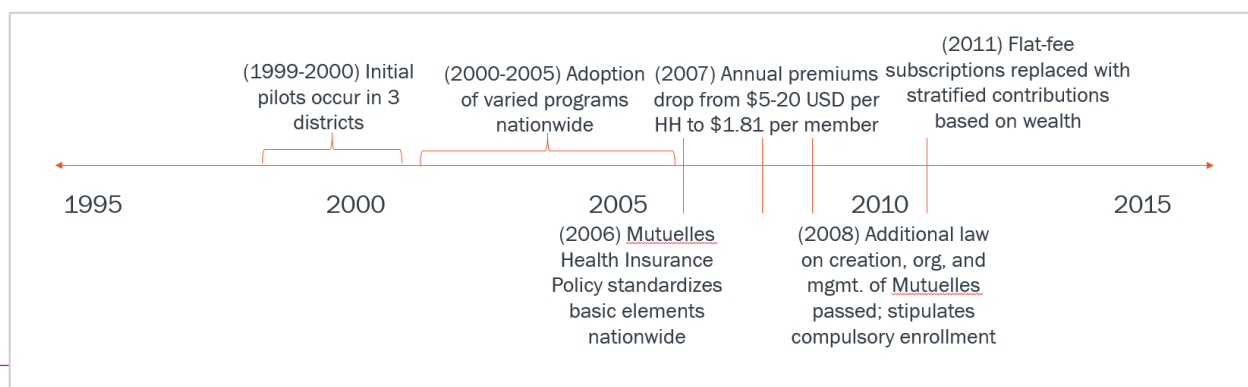
Rwanda improved financial accessibility of health services for the majority of Rwandans through *Mutuelle de Santé*, a national community-based health insurance (CBHI) scheme. This was conceived in the late 1990s. It was initially tested in 1999 before being fully rolled out in the mid 2000s.[94] Over the next decade, Rwanda adapted the system to make the payment tiered to ensure coverage of the poorest. Evaluation of financial status occurred through *Ubudehe*, a system of community peer assessment lead the Ministry of Local Government. In that system, the families in a village are classified in socioeconomic categories based on a simple but strict evaluation of their assets. The families in the lowest categories have their insurance premium and the co-pay at all points of care paid by the government or its development partners. It was only after acceptability, feasibility (including funding), and impact were proven that it was enshrined into law—as opposed to writing a law guaranteeing a program/entitlement that the government could not afford. At peak enrollment, over 90 percent of Rwandans were in the scheme (current estimates are at 75 percent) with one of the highest enrollment of CBHIs among LICs and LMICs.[95] Another portion of the society are enrolled in private health insurances, insurance for civil servants and insurance for people in uniform (police and military). The implementation approach and intervention design successfully increased access and lowered catastrophic health expenditures.

Metrics of success included:
- Large reductions in costs to the individuals for maternal, newborn, and child health (MNCH) services and free family planning[94]
- Essential local primary care services have an ~$0.33 co-pay (e.g., consultation)
  - Other care costs 10 percent of invoiced amount (e.g. hospitalization)
  - Cost to deliver at a health facility dropped from $25 USD to $2 USD[96]

5.4   System of Learning and Improvement

5.4.1   Data Utilization for Decision-Making, Learning and Improvement

Related to the accountability was the development of a culture for, and systems and capacity to, support data use for decision making and accountability. At the national level, this included resources committed to information system infrastructure (e.g. education in data collection and data use, internet coverage and data warehouse funding). This took additional work, including software development, improving data quality, and increasing capacity for and response to data use. The work was accomplished with the leadership of the MOH and coordination of partner support. As one key informant who had worked within the MOH and then with an implementing partner organization noted the need to have a platform for data in 2007. They noted that although health centers and district hospitals gathered data and sent it to the MOH, "it [was] not really in… the culture to analyze that data, to see what happened, and so on." They noted the decision to use one platform DHIS2 at ministry level and the investment in information technology (IT) and information systems resulted in better availability at the local level. "all the data went through that platform, and each level can see that data and can analyze themselves (over time). This

platform can help them to see how (things are working)." It also helps to identify variability and how and areas are performing compared to others.

KIs also noted that increased use was supported through improved data quality. This was attributed in part through the increased use of data for monitoring accountability and PBF. These provided a mechanism and consequences for data, which changed from reporting to a tool that could be used to reach identified targets.

Reflecting the results from the key informant interviews, there is evidence from periodic revisions of Vision 2020 to reflect the ongoing learning, data use, and willingness to continue to strive for better outcomes, rather than reach a goal and announce success.[97] One quarter (12, 26 percent) of the 47 original Vision 2020 targets set in 2000 were already achieved and 16 (34 percent) were on-track to be achieved including average GDP growth rate, agricultural production (kcal/day/person), infant mortality rate, secondary school transitional rate, malaria-related mortality, and admission rate to tertiary education. As a result of review of the data, more ambitious targets have been set for 2020 in cases where the indicators were already achieved. These included those directly related to health as well as areas which indirectly facilitated program support and health outcomes. These included:

- **Goals to achieve middle-income status, such as**
  - o increasing the per capita GDP target from $900 USD to $1,240 USD.
  - o Reducing the target for percentage of population living below the poverty level
  - o Increasing the voice of the population through inclusion of annual measures of citizen satisfaction with service delivery.
- **Health targets including:**
  - o Decreasing the fertility rate target of six in 2000 version to 4.6 and most recently to three in 2020
  - o Increasing the target life expectancy from 55 to 66 in the most recent version
- **Expanding goals to reflect ongoing and emerging challenges in health:** These included malnutrition, NCDs and quality.[97]

5.4.1.1   MOH Data Use

At the MOH level, data were then used to prioritize work and understand where gaps needed addressing. For example, in 2010 the MOH reviewed district data including the maternal death audit to understand where maternal and neonatal deaths were happening despite an increase in antenatal care. As a KI noted "I remember because we used all that data to present in [a] senior management meeting." "You need to have an explanation for why a district is not working well, so you have to talk to the district." This was then linked to accountability, with lower-performing districts presenting why they were struggling and plans with expectation of improvement at the next meeting.

Data are used to track the performance across the provinces and the 30 districts monthly. For example, the division responsible for maternal and child health has a data lead who produces data by district for key indicators for review to know which districts are performing well or not. These indicators include

occurrence of "never events" such as maternal deaths to drive audits (see section on maternal and child death audits below) and measles cases to inform vaccination campaigns and activate CHWs to monitor for further cases (see section on measles).

5.4.1.2 District Data Use

This required investment in infrastructure (teams at the district level which meet monthly to review health center and district wide data), use of data for accountability (*imihigo* or PBF) and learning culture to discuss what is going well and where improvement is needed. One KI reported that further data use was facilitated by their going to health centers to give feedback of results to drive change and by doing a written report that MOH can request during supervisions. This was following a policy coming from the national level for all districts.

5.4.1.3 Examples of Data Use for Decision-Making

National implementation and adaption of CBHIs to ensure financial access the health and protection, with a premium calculated as a percent of the average income and free for the 25 percent poorest, resulted in the following targeted changes in Vision 2020:

- MOH: Malaria treatment changes to require rapid testing by CHWs before treatment to reduce overuse of combination treatment (ACT), decision to use pneumococcal conjugate vaccine (PCV) to address high rates of pneumonia-related deaths, recognition that the neonatal mortality rate (NMR) was increasing as a cause of U5M, resulting in implementation of a number of EBIs including mentorship, training in all health facilities including health centers, and establishment of neonatal intensive care units and redesign to improve infection control among many (see neonatal section)
- District: Outreach to the community in response to identified vaccination coverage gaps and results of maternal death audits.

5.4.2 Culture of Innovation and Learning

From the 1990s, there was a spirit of focusing on implementing evidence-based interventions and research, then exerting enough effort to "make sure it worked," followed by a full implementation. This helped to leverage the technical expertise from the partners (see above) and helped rapid translation from research to availability at the national scale. Examples included pneumococcal vaccine, rotavirus vaccine and PMTCT Option B+. This also applied to interventions used successfully in other settings, such as CBHI, PBF, and iCCM. In Rwanda, these established interventions were rapidly implemented using strategies based on external evidence and local testing prior to scale-up to ensure effective and adaptive strategies.

A number of KIs described the commitment of the national and ministry leaders to continuing to improve and striving to achieve more difficult targets in health. According to one MOH official, "they [the MOH] don't always reach [their goals], but I think they recognize there is some value in reaching beyond what they have done before." To continue to push for better health outcomes, one KI noted the MOH's willingness to "take risks" and try new things through a process of testing, adaptation and scale. After 2011

some of this work was supported by the development of the RBC as the implementing arm of the MOH. Before that it was supported by the eight institutions which were merged to create the RBC.

Deliberate capacity building lead by the leaders of the health sector, was undertaken to ensure research capacity among the leaders (for production and consumption). This was noted as challenging at the start, and incentives were needed to ensure people found it a good enough investment to commit the time and effort. "[We make] sure that for every piece of evidence, we understand it and whether or not it suits what we are doing and supports our work or [instead requires us to] change our protocols to fit the evidence." This investment resulted in developing a team of decision-makers who allowed the minister of health to delegate decisions and create national capacity with division units who were experts and researchers. In addition, this created embedded research capacity to "produce evidence and science when it may not be available." This willingness to try innovations is ongoing, reflected in uptake of technology (e.g. use of phones for SMS reporting from CHWs and more recently drones for blood delivery).

5.4.3 Focus on Improving Quality

Rwanda has implemented a number of broad initiatives to improve quality as well as some which are more focused on reduction of U5M. Two were highlighted by KIs and the desk review: PBF and death audits.

5.4.3.1 Performance–Based Finance (PBF)

Rwanda first implemented pay for performance (P4P) schemes in two districts over a three-year period from 2003-2005. After initial success in the first two districts, Rwanda designed roll-out as a control before and after a study of 166 rural health facilities to generate evidence for impact.[98] The study found significant increases in the intervention facilities compared with controls in a number of areas including institutional deliveries (+23 percent), number of preventative care visits by children under 23 months old (+56 percent), and the number of preventative case visits by children 24 to 59 months old (+132 percent), although no significant improvements were seen in the number of women completing four prenatal care visits or children receiving full immunizations. P4P had the largest effect on the services that had the highest payment rates and were the easiest to render.[98]

Based on the evidence generated in Rwanda, PBF was adopted as a national policy as part of the 2005-2009 Health System Strategic Plan, including public health centers, nonprofit health centers supported by the government, and district hospitals.[86] Payment was based on 13 qualitative and 13 quantitative measures, which included some related to U5M. Payments were made quarterly. Eighty percent went to providers, and the remaining 20 percent went to non-labor costs.[91] Between 2003 and 2007, PBF funding increased from $0.8M to $8.9M and wages increased by 60-100 percent depending on the facility.[91] PBF also was identified as contributing to work to increase and maintain staffing levels and increase provider motivation to deliver quality services across Rwanda including in more rural areas. From 2005-2008, personnel in publicly funded facilities almost doubled, with much of the increase being from rural facilities this was due to the better financial take home by workers, the creation of nursing schools and increase up take at the medical school. This was in part due to the strong accountability, linking performance to a portion of payment (and "sanctions" if poor performance) and improvement. As one KI put it: "Slowly it

was seen as also quality improvement because if you have indicators you are willing to follow, you pay attention, think and moving your sense of QI."

5.4.3.2   Maternal and Neonatal Death Audits

The additional focus on understanding and improving quality has included instituting maternal and neonatal death audits. While death audits have been found to be critical to improving quality and safety of care, implementing them can be challenging in ensuring that the results are used for improvement and encourage an atmosphere of learning.99

One KI described the implementation strategy, which recognized the need to prepare the community for the process and create trust. According to this KI, it was not easy to establish the maternal and neonatal audit systems. Initially, health providers thought that the reports would be used for blame or punishment. The MOH held death audit meetings to review cases with providers, give feedback, and explain how the reports would be used.

In 2011, when the MOH introduced neonatal death audits, it was much more acceptable as the providers were already familiar with the maternal death audit. It resulted in actionable information, identifying birth asphyxia as a major cause of death. This led to implementation of a number of EBIs to reduce this cause (e.g. facility-based delivery and training in neonatal resuscitation). Asphyxia as a cause of death (COD) has dropped as these EBIs have been implemented with increased coverage (see section on neonatal deaths).

5.5   Designing Implementation Strategies for Scale and Sustainability from the Start

Implementation typically started with plans to adapt to reflect needs and capacity in Rwanda to increase feasibility and sustainability. Early in the process of implementation, the results were reviewed and changes were made as needed. "Using less and achieving more" and using evidence to drive adaption ("The only way to have continuity is to base action on reality") were core concepts noted by a number of KIs, along with adaptation led by the MOH with input from all stakeholders through the TWGs and providers ("even CHWs bring up challenges and ideas to adapt").

Rwanda had a number of other strategies for sustainability, some of which are described in more detail in the report. One was to have more health systems investments focusing on building systems able to support care in a number of areas, whether it was new health centers (geographic access) or building human resource capacity. Other key strategies which were incorporated into the U5M EBI implementation and across all interventions built on a number of the contextual factors noted above including:

- Accountability at all levels, from the providers and facilities to local government up through the ministry to the executive level for effective and sustained delivery
- Use and validation of data to monitor progress and change and strengthen accountability
    - E.g. All reports to the Prime Minister from all levels of government (MOH, local government, customs importation of drugs, etc.) have to match

- o "Big highway of reporting that in the end reaches the desk of his excellency"- was identified as important, as well as reporting to parliament including how the annual plan and budget have been executed
- Engagement of stakeholders at start and throughout including partners, experts, community, and other civil society
- Flexibility at the national and ministry level to respond to new threats
  - o E.g. Ebola was a "surprise" so the MOH had to reallocate for an unplanned activity and decrease other deliverables
- Monitoring and production of the science that is relevant and needed
  - o E.g. The MOH changed their protocol when their research showed that ITNs were effective for only two years in Rwanda rather than the five years according to the WHO
- Integration of research into the systems
  - o E.g. Every unit head at the MOH is a researcher

5.6 Focus on Equity

Commitment to equity is a priority integrated into implementation strategies and polices in Rwanda. This was reflected in the focus on financial protection, geographic access to care for even the most remote, planning for country-wide delivery from the start of EBI planning, and data review to identify and focus on who is not benefitting from programs.

5.6.1 Equity by Wealth

Attention to financial access to care through programs such as the community-based health insurance system also correlates with changes in equity between 2000 and 2015. In 2000, the U5M rate for the highest economic quintile was 156, but 229 for the lowest economic quintile – an equity gap of 73.[1] By 2014, this gap had decreased to 45, with a U5M rate of 38 for the highest quintile and 83 for the lowest.[2] Similar reductions can be seen in coverage of specific interventions.
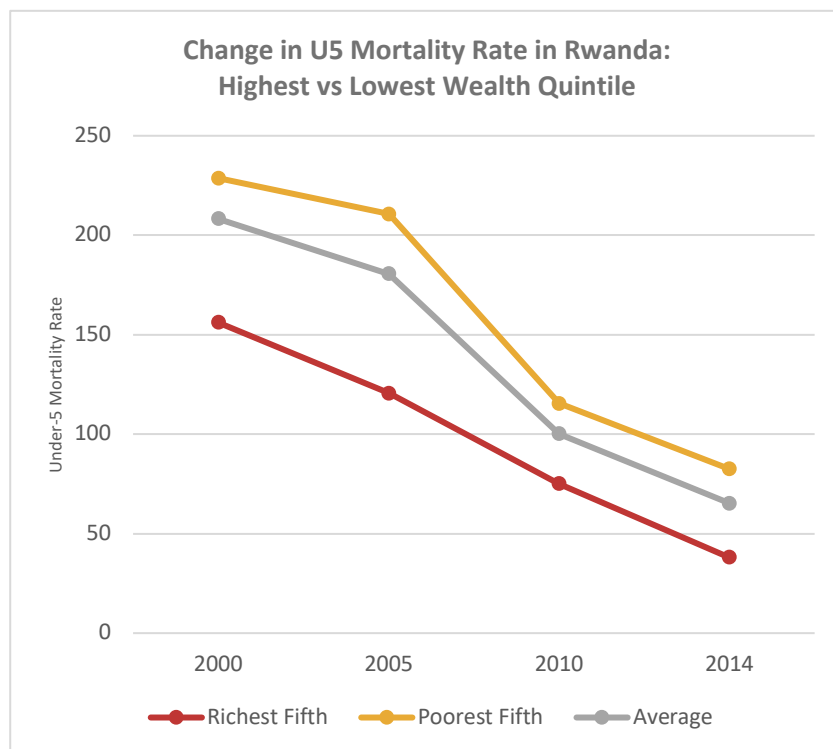
Figure 20: Change in U5 Mortality Rate in Rwanda: Highest vs. Lowest Wealth Quintile (Source: Rwanda DHS 2000, 2005, 2010, and 2014)

We also looked at the Countdown composite coverage index (CCI) which is a weighted average of the coverage of eight interventions along four stages of the continuum of care: reproductive health (demand for family planning satisfied with modern methods), maternal health (at least four ANC visits and SBA), immunization (BCG, three doses of DTP, and measles) and management of child illness (ORS for diarrhea and care seeking for children with symptoms of pneumonia). The CCI is widely used by the Countdown to 2030 initiative to track progress in coverage for reproductive, maternal, newborn, and child health, and represents a proxy for universal health coverage in this area.

Rwanda has worked to increase the coverage across these services while also significantly reducing the equity gap. While coverage can still be improved, the change among the poor allowed them to catch up to coverage among the wealthiest quintile. This degree of reduction in inequity is unusual across the Countdown countries.
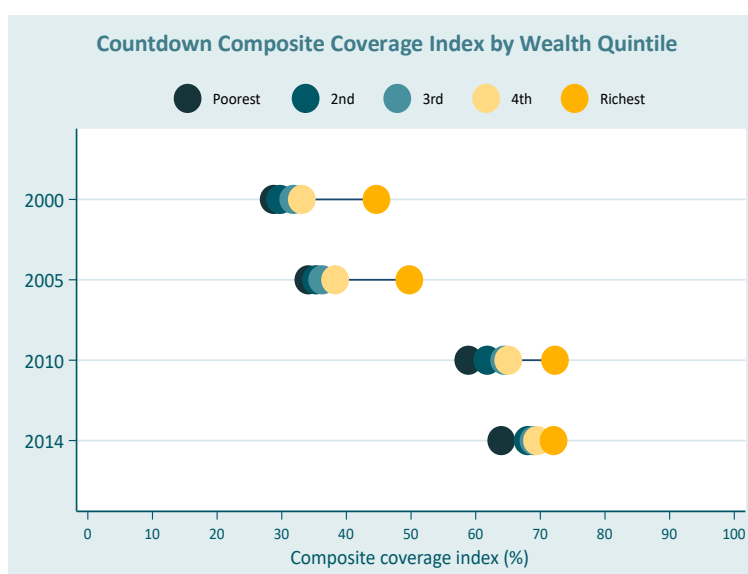
Figure 21: Countdown Composite Coverage Index by Wealth Quintile (Source: Victora et al)
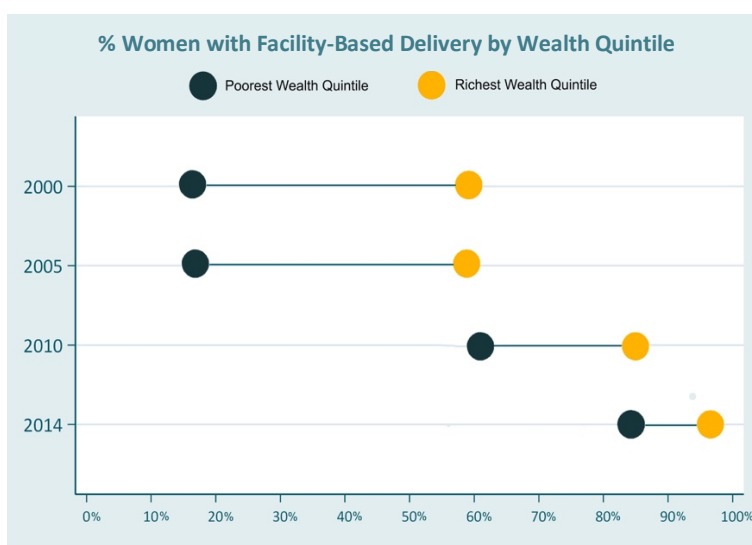
Figure 22: Percent Women with Facility-Based Delivery by Wealth Quintile (Source: Victora et al)

5.6.2 Geographic Equity

Data from national demographic health surveys show consistent reduction in U5MR across all districts of Rwanda from 2000 to 2014/2015. Maps generated by IHME and shared for this report show broad geographic improvement in U5M (Figure 20). When comparing the regions in the bottom 10 percent of the country for U5M rates, regions with the highest rates of U5M have largely moved overtime as progress has been made (Figure 23). This suggests that there are not areas which are being left behind. The one area which has remained with the highest U5MR (although improving) is in the southern region.
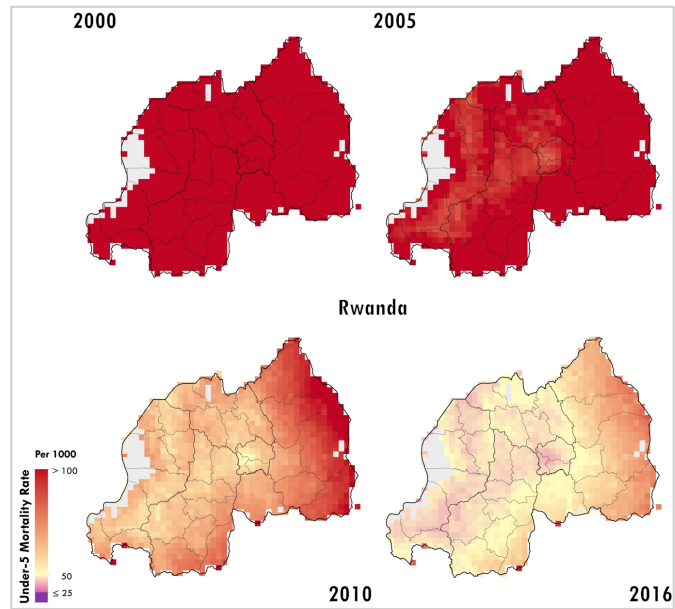
Figure 23: Geospatial Mapping of U5MR by Year
(Source: Local Burden of Disease Collaborators, IHME)
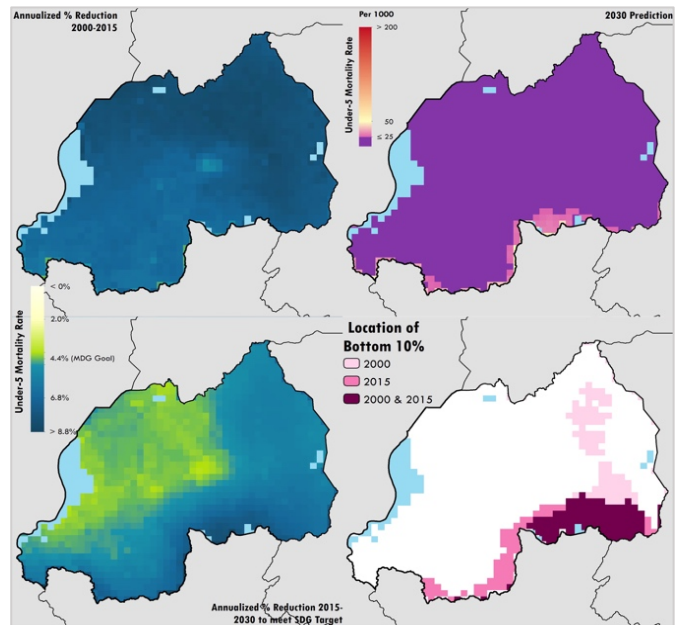
Figure 24: Geospatial Mapping of U5MR
(Source: Local Burden of Disease Collaborators, IHME)

5.6.3 Rural versus Urban

Some specific interventions show increases in equity of care for rural and urban populations between 2000 and 2015. With policies such as decentralization of the health care system, increase in the number of health centers and outposts nationwide, establishment of a CHW program delivering care, distribution of trained health professionals to rural areas by the central government, and community health workers in every village, the geographic access to hospitals, health centers, and trained health providers significantly increased over time. This is clear in the coverage for interventions such as facility-based delivery and care-seeking for childhood illnesses at a health facility or by a trained provider. In 2000, 66 percent of women in urban areas delivered in a facility, but only 20 percent of women living in rural areas.[1] By 2014, 97 percent of women in urban areas and 90 percent of women in rural areas delivered in health facilities, representing not only a significant total increase, but a dramatically reduced gap between urban and rural access to care.[2]

5.6.4 Sustained Equity

Other interventions show consistently high equity over time, such as vaccination campaigns. As is detailed below in this case study, vaccination campaigns in Rwanda scale rapidly nationwide, use needs assessments performed by CHWs in every village, and integrate with community health programs in order to increase equity.[7] This results in little variation in coverage geographically or socioeconomically from the outset. For example, throughout the period of interest, measles vaccination rates vary little between urban and rural populations (96.4 percent and 94.9 percent respectively in 2014) or wealth quintile (91.3 percent for the lowest and 97 percent for the highest in 2014).[2]
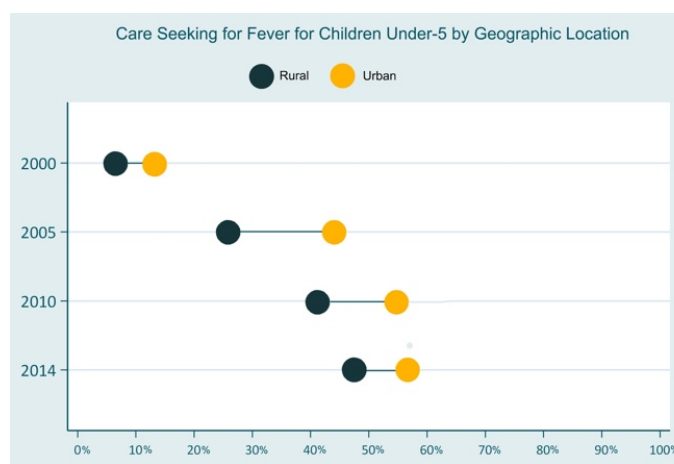
Figure 25: Care Seeking for Fever for Children U5 by Geographic Location (Source: Victora et al)
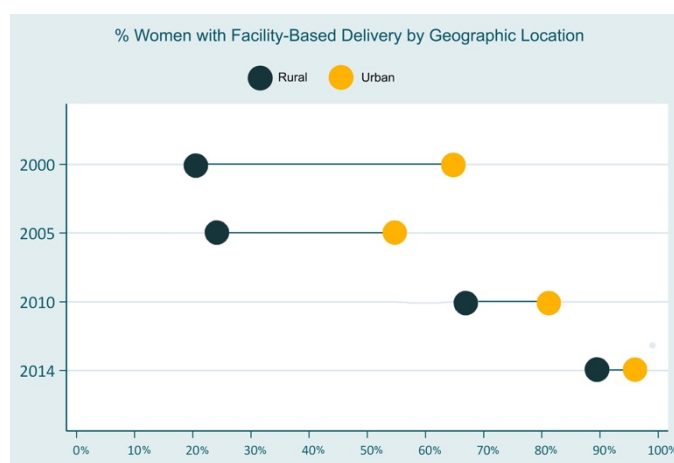
Figure 26: Percent Women with Facility-Based Delivery by Geographic Location (Source: Victora et al)
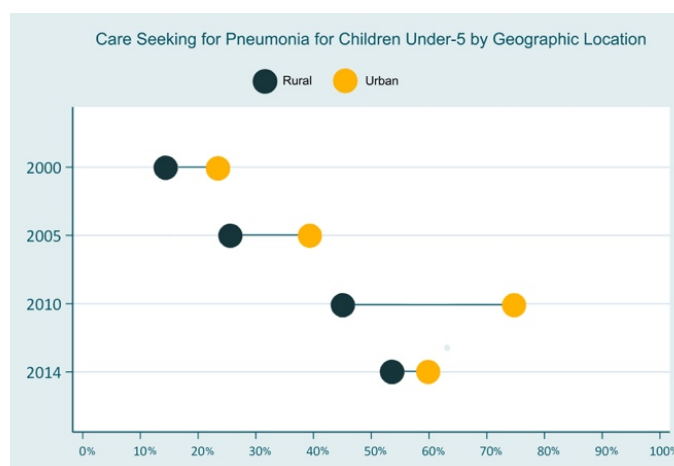
Figure 27: Care Seeking for Pneumonia for Children U5 by Geographic Location (Source: Victora et al)
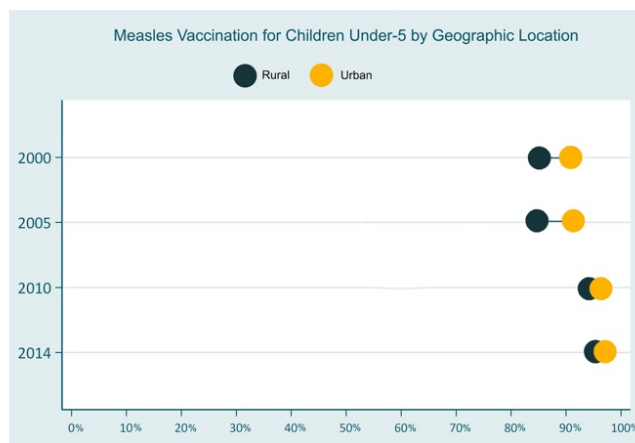
Figure 28: Measles Vaccination for Children U5 by Geographic Location (Source: Victora et al)
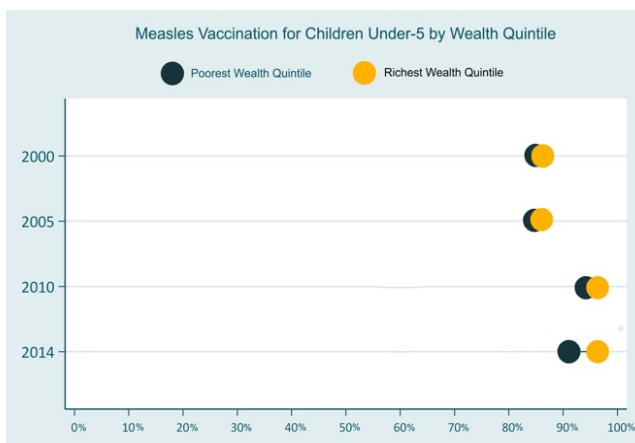
Figure 29: Measles Vaccination for Children U5 by Wealth Quintile (Source: Victora et al)

5.7 Commitment to Primary Health Care and Integration of Disease Specific Programs

According to a former minister of health, the vision for the health care system was to "create a system to build health infrastructure with the objective of equitable geographic distribution; grounded on a strong primary care platform, the principle of integrating new interventions into existing systems to strengthen their delivery, and the continuing goal of effective, affordable, and accessible primary health care."

This policy has led to funding being used to not only address disease-specific programs, but also to integrate their response in the primary care infrastructure. This has augmented the broader primary care infrastructure, which is critical to reducing U5M and achieving both the Millennium Development Goals (MDGs) and now the health-related Sustainable Development Goals (SDGs). In several cases, Rwanda was able to capitalize on funding parameters to garner more funding for general improvements. By meeting GAVI standards for child vaccinations, for example, Rwanda earned additional funds to strengthen its health system at the government's discretion.[100]

While **donor funding, particularly in the first 10 years after the genocide, was often earmarked for projects, the national and health sector policies ensured that resources were used to support** systems-strengthening efforts focused on primary health care (PHC) within and across programs when implementing specific U5M EBIs and in other areas of health care. This ensured that implementing a disease-specific intervention more broadly contributed to the health system. For example, implementation of the pneumococcal vaccine required multiple interventions within the implementation strategy and was also designed to strengthen future work for other vaccines (e.g. cold chain, CHW training, monitoring, community engagement/activation). This contributed to rapid roll out of rotavirus and other vaccines in the following year. Another example was funding for HIV where overall systems needed for HIV also served to support primary care (lab, cold chain, delivery rooms, etc.) so that there was integration from the start that strengthened the entire health sector. This resulted in high rates of HIV treatment, not to mention strong health systems. For example, during the initial GFATM application, work was done to map resources across

the entire health system. Meetings were held with all programs leads to review implementation plans to make sure that all disease specific programs were aligned and working together. (KI)

Using the Primary Health Care Performance Initiative (PHCPI) framework it was evident that the strategy of strengthening PHC addressed most of the domains identified as critical for creating the platform onto the rapid, effective, and sustained scale-up of the EBIs associated with the declines in U5M where able to be achieved. This included, strong policy interventions in many of the key areas including governance and leadership, health planning and financing, adjustment to population health needs, and ensuring inputs and access to PHC. Many of these strategies were also reflected in the Countdown framework inputs, including legislative initiatives, resources, health information systems, workforce and governance, and leadership.

Figure 30: PHCPI Framework (Source: PHCPI)

Table 17: Policy strategies mapping to PHCPI framework from national and ministry level key informants

	Frequency of themes	Examples
A. System		
A1. Governance and Leadership		
PHC policies	+++	Financing of HC facilities, investment in CHW, targeting in coverage of key PHC interventions, integration of disease specific program funding to strengthen PHC
QM infrastructure	+	PBF, accreditation
Social accountability	+++	Feedback of data, incorporation of health metrics in imihigo, inclusion of community voice in policy development

	Frequency of themes	Examples
A2. Health Planning		
Payment systems		Not discussed
Spending on PHC	+++	Increase in expenditure for health and focused on OHC
Financial coverage	+++	Mutuelle de Santé
A3. Adjustment to Population Health Needs		
Surveillance (MOH)	+++	Strong system to collect and review for outbreaks and change in disease burden
Priority setting (National, Ministry, Local)	+++	Harmonized with other ministries, data-driven, integrating equity through strong PHC
Innovation and learning: National, MOH	+++	Capacity built to use and produce data, modification of strategies when not as effective (e.g., Malaria), rapid uptake of new interventions (e.g., new PCV, Option B+)
B. Inputs		
B1. Drugs and Supplies	**++**	**Strengthening overall supply chain while rolling out for specific vaccines**
Facility infrastructure	+++	Commitment to health center within 5 km and now expanding through health posts
Information Systems	++	Early investment in HMIS and feedback loop for facility and CHW-delivered care
Workforce	+++	Minimum standards incorporated into health system strengthening, targeted capacity-building focused on nurses (from A2 to A1), CHWs and all HWs as new interventions are introduced.
Funds	+	Funding for HCs tied to quality and usable for local initiatives
C. Delivery		
C1. Population Health Management		
Local Priority setting	+++	Engagement with civil society through imihigo
Community engagement	+++	Most new interventions included investment in community outreach and education, engagement with local leaders
Empanelment	+	CHW coverage of a village, not as specific for a HC
Proactive population outreach	+++	CHWs serve as active outreach visiting housing and available for care in the community
C2. Facility Organization and Management		

	Frequency of themes	Examples
Team based care organization		Not explored
Facility management capability and leadership	+	Not a specific area of focus for this project. Discussion of capacity through HMIS data use to ensure accountability
Information systems	++	Investment in HMIS and data feedback
Performance measurement and management	++	PBF, review of CHW data, neonatal death audits
C3. Access		
Financial	+++	Mutuelle de Santé
Geographic	+++	Decentralization and facility building
Timeliness		
C4. Available Effective PHC		
Provider availability	+	Strategic plans to increase HCWs across Rwanda (DHSSP) and PBF (retention)
Provider competence	+	CHW and HCW supervision
Provider motivation	++	PBF, data feedback, capacity building, training and supervision
Pt-provider respect and trust		Not explored
Safety	+	Infection control for neonates
C5. High Quality PHC		
First contact Access	+++	Priority on PHC through health centers and CHW
Continuity	+	CHWs program designed to increase f/u (post-natal) and referrals to HFs (U5 and pregnant women)
Comprehensiveness	+	Strengthened referral process, expanding neonatal care services
Coordination	+++	Communication for referrals between HC and DH and CHW and HC
Person Centered	++	Engagement of community in prioritization, scale-out of new programs, CHW as linkage to community

6 Lessons Learned

The framework, results from the desk review and key informant interviews, and cross-cutting synthesis of EBI implementation were used to identify the general steps that Rwanda used to effectively choose, adapt, implement and sustain EBIs associated with reductions in U5M. Strategies have included incorporating core concepts of adaptive management with systematic M&E to identify and analyze failures and drive improvement; learning systems and implementation science supported by clear assessment of the situation before designing a program; a strong system of data collection and use; accountability for all key stakeholders; and communication. These are summarized below and reflect ongoing learning within UGHE on effective global health delivery. This work reflected and built on the ongoing work to identify the broader strategy applied across intervention implementation within and beyond MOH work to reduce U5M and is reflected in other similar successes in Rwanda.

6.1 Generalized Steps for Implementation of U5M Interventions in Rwanda

STEP ONE: EXPLORATION USING DATA, RESEARCH, AND EVIDENCE
- Identify the need.
- Identify key stakeholders and start the process of informing and engaging.
- Conduct research to:
  - Quantify the needs and underlying causes;
  - Quantify the impact of the need including human, developmental, and financial consequences.
- Conduct research on how to address the need and to plan with evidence:
  - Review published evidence and global guidelines; field assessment and interviews, design new research where there are no identified relevant Evidence Based Interventions (EBIs);
  - Stakeholder engagement and input (community, financial and technical support of donors/partners, in the health sector and other sectors).
- Identify the interventions that can address the need for integration into existing national systems, providing that category of services and information systems.

STEP TWO: PREPARATION USING EVIDENCE
- Choose the evidence-based intervention(s) that are the best fit for the health sector at that moment:
  - Matching need, potential desire, impact, feasibility, and acceptability (fit);
  - Include projections of the expected cost, timeframe, expected human, developmental or financial impact of each intervention;
  - Gather stakeholder input around consensus-building to ensure national trajectory is followed and that the goal and targets are achieved from the Rwandan Government leadership.
- Identify the budget and resources needed (such as equipment, infrastructure, health worker, training, etc.).

- Develop an implementation strategy with a clear definition that is the responsibility of all stakeholders to uphold and inform all those concerned through technical working groups (TWGs) and other coordinating platforms.
- Develop evidence-based guidelines and a legal framework for accountability.
- Plan for M&E-framework, indicators, and systems.
- Test interventions locally:
  - Determine the feasibility and acceptability of the study.
    - Can it be implemented?
    - Are initial changes seen?
    - Do we need to adjust after the test?
    - Do we have to abandon for an evidenced identified reason?
- Plan for sustainability before you start:
  - Policies, laws, curricula for in-service education, regulation, and financial needs up to the test phase and later for the implementation at scale and sources. (Important to start because waiting for sustainability is a pretext for status quo)

STEP THREE: INITIAL IMPLEMENTATION NATIONALLY (A NATIONALLY HARMONIZED WAY TO IMPLEMENTATION)

- Disseminate implementation strategies to all those concerned through TWGs, coordination, and decision-making platforms.
- Train personnel on intervention and implementation, as well as all stakeholders (especially in the community) on engagement/sensitization.
- Implement intervention based on guidelines.
- Develop an accountability framework to assess.

STEP FOUR: SUSTAINMENT THROUGH ADAPTATION, MONITORING, & INTEGRATION

DATA DRIVEN AND EVIDENCE-BASED ADAPTATION

- Determine if gaps exist in implementation and impact:
- Conduct regular reviews of M&E data and reviews of beneficiaries as well as services providers.
- Do an evaluation to determine where more changes are needed for improvement and efficiencies, and why.
- Conduct ongoing research to identify new and better evidence-based interventions and advances in science for repeat exploration with preparation to adapt, add or replace.
- Adapt continuously to changes in policy, implementation approaches, interventions, and identify new resources needed.
- Disseminate changes and support with ongoing training, sensitization, policies and needed system changes.
- Continuously revise the implementation.
- Regular ongoing evaluations of M&E, data, and evidence-driven adaptations.

INTEGRATION AND SYSTEMS SUSTAINABILITY

- Continue ensuring funding in national budget and/or through donor support.
- Cultivate a culture of evaluation and implementation of needed changes to ensure that this approach becomes "business as usual".

Integrate training and capacity-building in pre-service education, in day to day citizen interactions, and in professional lives.

6.2 Evolution of Understanding of Contextual Factors Impacting EBI Implementation and Effectiveness

As noted above, we continued to adapt the key contextual factors in the framework based on the results from the interviews, which identified a number of new ones which affected EBI implementation, effectiveness, and scale. These changes will be reflected in the framework as it is applied to other countries.

Table 18: Selected Contextual Factors Identified Supportive of EBI Implementation in Rwanda

Global	MOH
- Global events (war, economic stability, etc.) - International funding and priorities - Natural disasters/Climate - Technical advancements/new knowledge - Major improvement in global solidarity (BMGF, Global Fund, PEPFAR, PMI)	- Leadership - Culture of accountability - Mission and values - Decision-making process - Community and stakeholder engagement - Coordination inside the health sector (TWG, JHSR, SMM, GSMM) - Coordination with other ministries - Donor and NGO coordination with national programs designed with all stakeholders and that all need to follow - Data availability/use - Culture of learning and research utilization - Organizational structure (internal and decentralization) - Capacity development
National and Sub-National	**Community**
- Leadership (national and local) - Political stability - National priorities (health, non-health) - Economic development - Legislation/policies - Accountability - Competition on results - Infrastructure (health and non-health) - Financial commitment to health (Proportion of budget spent on health) - Equitable health budget per district - Support and coordination between ministries - Donor coordination - Community coordination engagement and advocacy - Community health legal framework (community health policy, protocol and guideline) - Decentralization policies - Technical capacity - Data availability/use - Research utilization - Continuous analyzing and use of global regional and local opportunities	- Engagement in health care: (Clear national Community Health Policy) - Knowledge of health care - Underlying community assets - Community activism (accountability) 10 Umbrella: Representing all major categories civil society invited to be part of TWG and JHSR

6.3 Overlap with Lessons from Countdown 2015

Reflecting the significant investment into the analysis of Countdown 2015 countries, we also compared our results with cross-cutting policy and system factors identified as associated with success (or lack thereof) in reducing maternal and child mortality by the Countdown team.[101] Rwanda was found to be strong across most of these areas, suggesting that a number of these areas are replicable in other countries, providing the platform (organizational, cultural, governance) through which the implementation strategies for EBIs are delivered could be put into place.

Table 19: Factors identified as facilitating or hindering Progress to MDG4 and 5 from Countdown 2015. (Source: Moucheraud et al.)

Factor	Examples
Leadership and Governance	Peru-political commitment
Political stability	Tanzania, Peru
Political commitment to policy and policy to action	Tanzania
Data-informed policy making linked to implementation	Multiple countries for neonatal mortality
Health care financing	
Integrated and comprehensive policy	Tanzania-One Plan Ethiopia
PHC focus	Multiple countries
Decentralization	Ethiopia, Peru, Tanzania (both + and (-))
Expanded access through community-delivered care	Ethiopia: HEW
Ensuring supplies and equipment	Ethiopia, Malawi
Health care worker (adequate and equitable)	Ethiopia: HEW Malawi: emergency resource plan
Integrated Health System design	Afghanistan

6.4 Gaps Remaining

A number of existing or ongoing challenges were identified by KIs and the desk review. All of these have become a focus of work for the MOH and a number are addressed above. The most prominent ones were related to neonatal mortality (see above) and (while not directly related to U5M), chronic malnutrition.

The verbal autopsy from CHW-reported U5 deaths also has found some gaps in the system including lack of insurance, lack of knowledge of families (e.g., not taking medications as prescribed) and ongoing reliance on traditional healers. These will require ongoing monitoring and strengthening of systems, communication and supervision.

Other challenges identified include causes of death that will require more resources and complexity of care. These include ambulances to get severely ill children to health facilities, neonatal mortality reduction as

noted above requiring training of health care workers in basic resuscitation (at health centers) and more advanced care (at hospital), as well as establishment of neonatal care units at district hospital.

Ensuring quality is an ongoing challenge, for example in delivery of IMCI and neonatal care. While there was improvement due to existing interventions such as PBF, Similar to many countries, due to high job mobility of the staff trained means that programs are obliged to redo the training of nurses and doctors in neonatology ward many times due to turnover. In addition, reflecting evidence of the limited impact of didactic training, work to ensure that clinical competency is not only achieved by sustained through practical training and ongoing supervision will be important.

6.5   Replicable Lessons for Other Countries

Key informants were asked what could be replicated in other countries from the experience in Rwanda. These inputs were based in part on work they had done in specific countries, visits to countries in the region, and study tours other countries had made to Rwanda. While there was general acknowledgement that Rwanda had some intrinsic contextual factors that are not easily adoptable by other countries (e.g. small size, post-genocide peace, strong visionary leadership at the national level, a culture of working together to implement national mandates), the key informants identified a number of areas where change could be implemented both in the national policy and governance as well as implementation strategies. These included:

1. **Ensure accountability at all levels.** From the president down to local village leadership, Rwanda has built systems of accountability into their health care system and general governance. As detailed in this case study, the *imihigo* system built on reinvigorating long-standing, precolonial cultural values in the country to establish public performance contracts for all levels of government. Some international partners expressed the desire to replicate *imihigo* in other countries, but others doubted the ability to do so in the absence of the specific cultural tradition as exists in Rwanda. Along with *imihigo*, Rwanda also implemented performance-based financing for health care workers, strong data collection systems for monitoring and evaluation, and transparency in the national policy-making and financial systems. The many layers of accountability in Rwanda – within and between the national government, local government, partners, donors and the general population – require broad support from the top levels of leadership with clear accountability expectations and mechanisms. This can range from routine data review to enforcement for illegal activities such as imprisonment for health care providers for embezzlement detected on audit. Ministry of Health officials and non-government partners proposed possible methods of adapting the Rwandan systems of accountability by adopting on a subnational level in larger, more decentralized countries, or focusing on accountability between health workers, health facilities and the Ministry of Health, instead of adopting accountability systems government-wide.

2. **Build capacity of your implementers and policymakers in the ministry and locally.** Rwanda focused on training and retaining human resources within the health care sector, both with practitioners and policymakers. By requiring that all department and unite heads at the Ministry of Health or the Rwanda Biomedical Center attain master's degrees, Rwanda built capacity and created internal

technical experts. Key informants described these technical level MOH employees as "the engine" and "the backbone" of the health system, more so than the minister or other leaders. Creating this capacity required giving employees time, funding and institutional support for graduate education, including coordinating with the School of Public Health to design a master's degree that could be attained while working. But this effort established the MOH as a center of research for the country and, according to both MOH employees and non-government partners, effectively retained skilled and motivated staff who otherwise could have sought higher salaries outside of the government. Further education and training also encouraged policymakers to rely on their own data collection and analyses, and to innovate based on in-depth understanding of relevant topics and local context.

3. **Appoint policymakers based on ability and hold them accountable to the people they are serving.** The Rwandan Ministry of Health used a variety of transparency and accountability mechanisms to ensure policymakers are capable and effective in their positions. As one MOH official said, "otherwise [you are] setting yourself up for failure." Replicable systems in place in Rwanda include regular reporting for policymakers, like the senior management meetings at the RBC and other government bodies. All senior level leadership, from director-level up to the minister, meet weekly to report on activities. As discussed more thoroughly in the accountability section of this report and above, performance contracts signed between mayors and ministers with the president, and then made publicly available and publicly reported on, keep policymakers accountable to those above and below them. One replicable approach is that all staff in the MOH sign performance contract with their direct supervisors. All contracts must make clear objectives that are measurable, and then document the actions taken, challenges faced, and milestones achieved.

4. **Change the culture of data use to include training, increased data use and quality, and linkage to accountability systems.** Rwanda's culture of data use from the top to the bottom of the health system is a key replicable aspect of their success. Quality of data is ensured through electronic systems and real-time reporting, good data collection tools at the clinic level, regular checks at the peripheral and central level, and regular updates of the reporting systems. Collection of high-quality data is incentivized through performance-based financing and performance contracts, with negative consequences for low-quality or limited collection of data. As well, according to multiple Ministry of Health officials, accurate data relies on training individuals in how the data will be used in decision-making processes. By educating health sector workers about evidence-based programs and policy making, their understanding of the purpose of data collection transforms from simply satisfying someone at the central level to instead improving the health and well-being of their communities. Specifically, showing examples of times when a false of methodologically incorrect report led to negative consequences for the country can encourage accurate reporting. As well, check quality regularly with independent auditors. Aside from collection by local health system workers, including data quality and reporting in donor contracts ensures that donors and partners are accountable to national plans and show quantifiable improvements.

5. **Support leadership at all levels.** Many of the transferrable lessons listed here are dependent on and contribute to the larger goal of creating strong leadership at the national and local levels. The

accountability systems noted above, including performance contract monitoring and evaluations, encourage leaders to prioritize achieving what they have identified and develop as the goals for their communities. According to a MOH official, these systems encourage leaders to promote policies that are evidence-based and results-driven. Multiple MOH officials contended that the example set by the ministers and the top national leadership also create a productive culture of competition to achieve the highest possible standards and largest measurable improvements. Although systems of accountability and data usage might be replicable, the culture of improvement promoted by the national leadership and carried down through the community level will require additional work and prioritization.

6. **Create laws, policies, and regulations, and enforce them to ensure quality and delivery.** Rwanda formulated national policies and legal frameworks to better define and implement their vision for health. With national policy documents, such as Vision 2020 and the Health Sector Strategic Plans, Rwanda outlined their national priorities and made ministries accountable to these. Similarly, implementing partners were more easily held to the national vision as established in policy documents. Legal frameworks ensured effectiveness and feasibility of these larger policies. Examples include making it illegal to purchase expensive pharmaceuticals when generic options are available or the outlawing of the importation of non-insecticide treated bed nets. One Ministry of Health official emphasized the importance of adapting laws to fit the local context. Policies and laws, once introduced, must be updated regularly based on changes in evidence and the results of regular assessments. For example, Rwanda was able to implement groundbreaking nationwide PMTCT policy by using this strategy of creating national policy with the input of experts and community members, regularly reassessing policy in light of advancements, and using these established policies to direct the efforts of a variety of partners across the country.

7. **Engage the community and civil society at all levels and in meaningful ways, including through bylaws and national regulation.** This was accomplished in Rwanda through a number of approaches, many of which could be adapted for other countries. These included ownership and opportunities for co-creation of health policy and programs. Rwanda gave ownership to decentralized entities. For example, by law, one of the vice mayors of each district is in charge of and accountable for the health sector of the district. As well, through intentional design of legal and organizational structures, civil society can be a part of accountability systems and the planning and validation of health sector activities. This engagement process needs to exist throughout – always getting consensus of all stakeholder, including the concerns of citizens or civil society groups, on all legal frameworks, strategies, plans, and design of programs and activities.

8. **Invest in health systems and inputs, including physical accessibility and quality.** Rwanda invested in geographic accessibility within their health system, aiming to build health facilities within an average of 30 min distance for all citizens. The number of health centers increased from 252 in 2001 to 495 in 2015.[51] Each of these health centers underwent regular supervision by the districts hospital and the central level to accurately assess what was happening in improvement of quality of health services and management and what investments needed to be made for improvement. This approach, coupled

with the fiscal decentralization providing overall for the same budget per capita across the country improved access to health in remote areas. there was also an ongoing focus on equity with some health centers also needing consistently more investment than other, due to large catchment areas or high burden of disease. Appropriate distribution of funding relies on quality data collection (discussed elsewhere in this case study) and regular, standardized supervision of health facility operations.

9. **Coordinate donor and NGO activities.** Rwanda leveraged financial and technical resources to engage partners to work towards national goals and policies. They used specific strategies both to guide the work of partners and to say no to partners who would not work within the government's requirements. This approach, using logic, a strong evidence base, arguments for sustainability, and legal frameworks, can be adopted by governments to effectively coordinate donor and NGO activities nationwide. Both MOH officials and individuals working at partner organizations said that managing the work of partners and donors was much easier when well-developed strategies and policies were in place. Through the technical working groups, partners participated in all legal framework development, program planning and monitoring design. For example, the PMTCT policy is updated every two years, with the contribution of national and international experts coordinated by the MOH, to ensure that it based on data and set nationally. Respondents noted that, as a result, partners would adopt the national policy and adapt to these updates, enforced as needed by national policy and law (see above). According to an individual working at a partner organization, when the government has a clear vision expressed firmly by the leadership, "donors fall in line." The leadership must understand that donors will not walk away from a program if the government has a coherent and evidence-based explanation for their plans and has engaged the donors and implementing partners. One MOH official also stated that including an argument for sustainability further encourages partners to follow national government policies; the country will only take over programs and structures that are in the national plan. As well, Rwanda has put in place legal frameworks requiring the cooperation of partners with the national government and the sharing of data between partner organizations.

10. **Ensure financial accessibility and protection through systems designed to ensure equity.** Rwanda models two methods of ensuring financial accessibility to health care. The first is a community-based health insurance system, such as *Mutuelle de Santé*, that concentrates on giving access to the most vulnerable in the community. A ministry of health official emphasized that any health insurance system must focus on sensitization of local leaders and communities, not just on the importance of individual health insurance, but on how individual participation in a health insurance system contributes to access to care for the most needy. Second, equitable financial accessibility in Rwanda relies on affordable essential services at the local level, even without health insurance coverage. According to key informants working within the Ministry of Health, decentralization of health services such as delivery and management of childhood illnesses, not only increases the geographic access to care but also drives down the financial barriers to care. Providing these services at local health centers or by CHWs makes access more affordable, regardless of an individual's health insurance coverage.

11. **Engage the private sector as key partners in care delivery.** Rwanda was able to achieve more through leveraging the private sector for health care delivery. Examples include increasing the number of health posts through a public-private partnership (PPP) framework with a private nurse working in a health post belonging to the community and expanding the need for specialized care by partnering with dialysis centers in a PPP. The MOH signed agreements with the owners of health facilities belonging to non-governmental and faith-based organizations for their properties to provide the same package of services as the one provided by the public sector. In return these health facilities received the same government support for salaries, equipment, and infrastructure as the public health facilities do. This increased the number of district hospitals and health centers available to the population.

12. **Plan for equity from the beginning.** As explored earlier in this case study, Rwanda's focus on equitable distribution of care led to lessening of differences in equity both geographically and socioeconomically. According to one key informant, equity has been a central part of Rwanda health care policy from the beginning because it was made a part of Rwanda's foundational legal frameworks. By establishing national policies such as the EDPRS 1 and 2 and including equity in the Vision 2020, Rwanda "put equity at the heart" of all policy to come after. Carrying out their equity agenda, required the government to identify the most vulnerable, often using local level officials or CHWs to collect data on the resources and needs of populations. As well, whenever possible, the government required local support and involvement to best understand and address the needs of the most vulnerable. One MOH official provided the example of implementing the *Mutuelle de Santé* insurance system. Although *Mutuelle* aimed to provide free health insurance to the poorest portion of the population, individuals needed passport photos to put on their insurance cards. Without local involvement, national policymakers would not have identified and worked around this barrier.

7 CONCLUSIONS

Rwanda's success was due to a combination of national and ministry-level policies and strategies which cut across health system design, accountability and governance, as well as an overarching strategic approach to implement EBIs. While there were some factors which were specific to Rwanda, a number of these were identified as replicable within other countries to help accelerate effective and sustainable implementation of EBIs, with ongoing learning and adaption to ensure that the interventions and implementation strategies provide for a resilient response to ongoing deaths of the most vulnerable. The method the country has used across EBIs from the assessment of needs using scientific and all stakeholders' knowledge; the implementation process, the law, strategies, program, action plans and monitoring and evaluation design and the general accountability system put in place can be customized elsewhere according culture.

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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 bgC3 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 causes of death - 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 LMICs; and 2) understanding how the evidence-based interventions implemented by a country were l through both existing publicly available sources and primary key informant interviews. **The work was guided by the development of a framework which was informed by a number of existing frameworks in use for U5M (e.g. 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 (e.g. vaccinations, safe birth practices, insecticide treated nets), and those treating illness or other complications (e.g. antibiotics, antimalarial medication, neonatal resuscitation). We included interventions that were at the individual process level (e.g. administering the right antibiotic and the right time) as well as those targeting inputs (e.g. development of NICUs) and systems needed to deliver the EBIs meeting the definitions of quality including effectiveness, safety, timeliness and equity (e.g. community health workers). 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 causes of death seen in some countries, with low birth weight (LBW) and prematurity increasing in importance in causes of mortality.[102] [e]

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[e] IHME U5 Paper

Table 20: Infant and Child Under-5 Mortality Evidence Based Interventions

Cause of Death	Evidence-based interventions	
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 6 months	
	Continued breastfeeding and complementary feeding after 6 months	
	Vitamin A supplementation	
	Management of severe acute malnutrition (ready-to-use food, rehydration, antibiotics)	
HIV	Antiretroviral 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 C-section for untreated HIV+ mothers**; replacement feeding**
		Antiretroviral 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 VL*

Table 21: 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		
	C-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 RDS 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 informed by a number of existing frameworks and designed specifically for this project. While we are often able to identify policies and evidence-based interventions 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:

1. **Exploration, Preparation, Implementation, Sustainment (EPIS):**[103] 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.
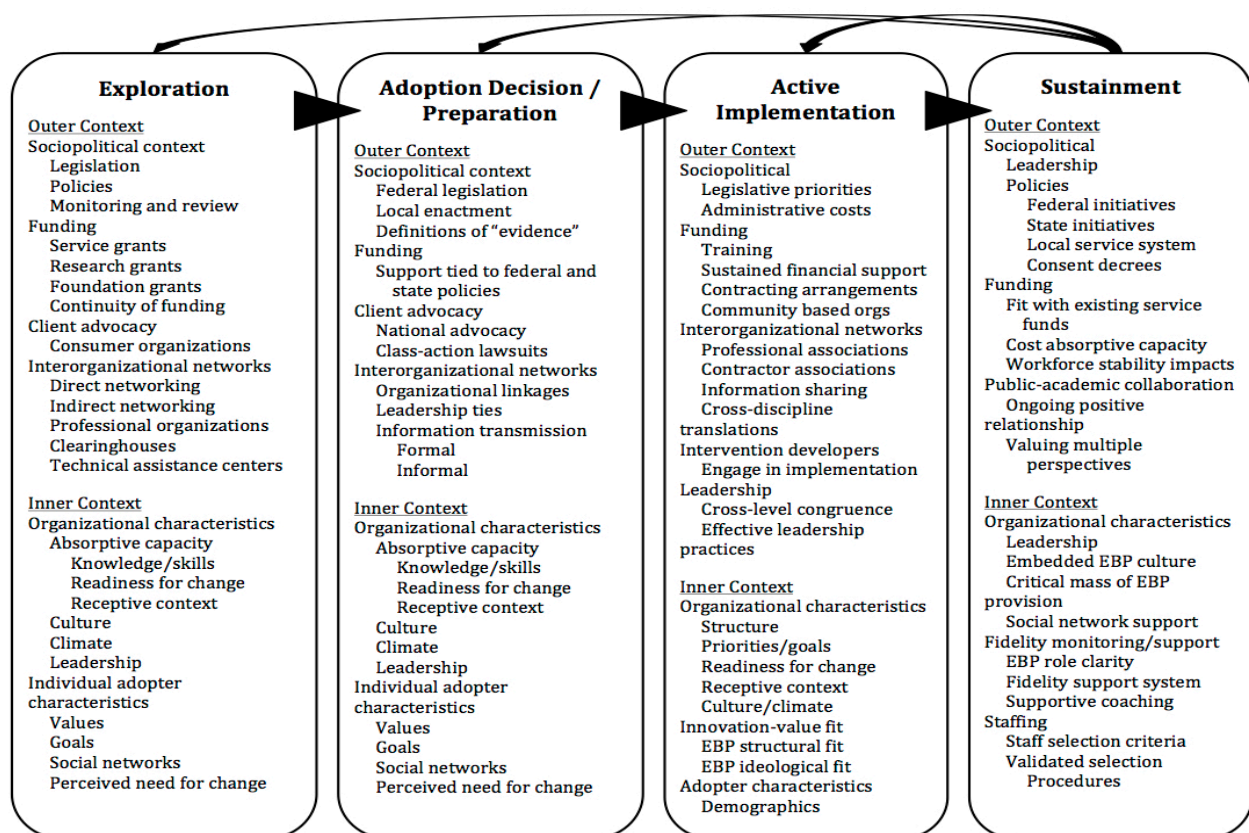
Exploration

Outer Context
Sociopolitical context
   Legislation
   Policies
   Monitoring and review
Funding
   Service grants
   Research grants
   Foundation grants
   Continuity of funding
Client advocacy
   Consumer organizations
Interorganizational networks
   Direct networking
   Indirect networking
   Professional organizations
   Clearinghouses
   Technical assistance centers

Inner Context
Organizational characteristics
   Absorptive capacity
     Knowledge/skills
     Readiness for change
     Receptive context
   Culture
   Climate
   Leadership
Individual adopter characteristics
   Values
   Goals
   Social networks
   Perceived need for change

Adoption Decision / Preparation

Outer Context
Sociopolitical context
   Federal legislation
   Local enactment
   Definitions of "evidence"
Funding
   Support tied to federal and
     state policies
Client advocacy
   National advocacy
   Class-action lawsuits
Interorganizational networks
   Organizational linkages
   Leadership ties
   Information transmission
     Formal
     Informal

Inner Context
Organizational characteristics
   Absorptive capacity
     Knowledge/skills
     Readiness for change
     Receptive context
   Culture
   Climate
   Leadership
Individual adopter characteristics
   Values
   Goals
   Social networks
   Perceived need for change

Active Implementation

Outer Context
Sociopolitical
   Legislative priorities
   Administrative costs
Funding
   Training
   Sustained financial support
   Contracting arrangements
   Community based orgs
Interorganizational networks
   Professional associations
   Contractor associations
   Information sharing
   Cross-discipline translations
Intervention developers
   Engage in implementation
Leadership
   Cross-level congruence
   Effective leadership practices

Inner Context
Organizational characteristics
   Structure
   Priorities/goals
   Readiness for change
   Receptive context
   Culture/climate
Innovation-value fit
   EBP structural fit
   EBP ideological fit
Adopter characteristics
   Demographics

Sustainment

Outer Context
Sociopolitical
   Leadership
   Policies
     Federal initiatives
     State initiatives
     Local service system
     Consent decrees
Funding
   Fit with existing service
     funds
   Cost absorptive capacity
   Workforce stability impacts
Public-academic collaboration
   Ongoing positive relationship
   Valuing multiple
     perspectives

Inner Context
Organizational characteristics
   Leadership
   Embedded EBP culture
   Critical mass of EBP provision
   Social network support
Fidelity monitoring/support
   EBP role clarity
   Fidelity support system
   Supportive coaching
Staffing
   Staff selection criteria
   Validated selection
     Procedures

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

(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):**[105] 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):**[106] 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.
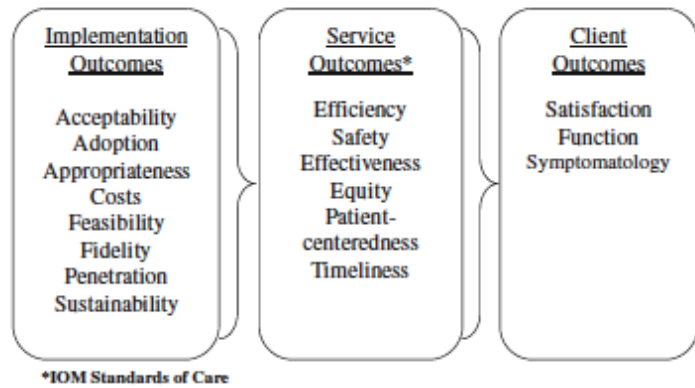

Figure 32: Types of outcomes in implementation research (Source: Proctor, et al)

5. **The implementation principles for managing all levels of a health sector as described in the book in progress by Doctor 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.
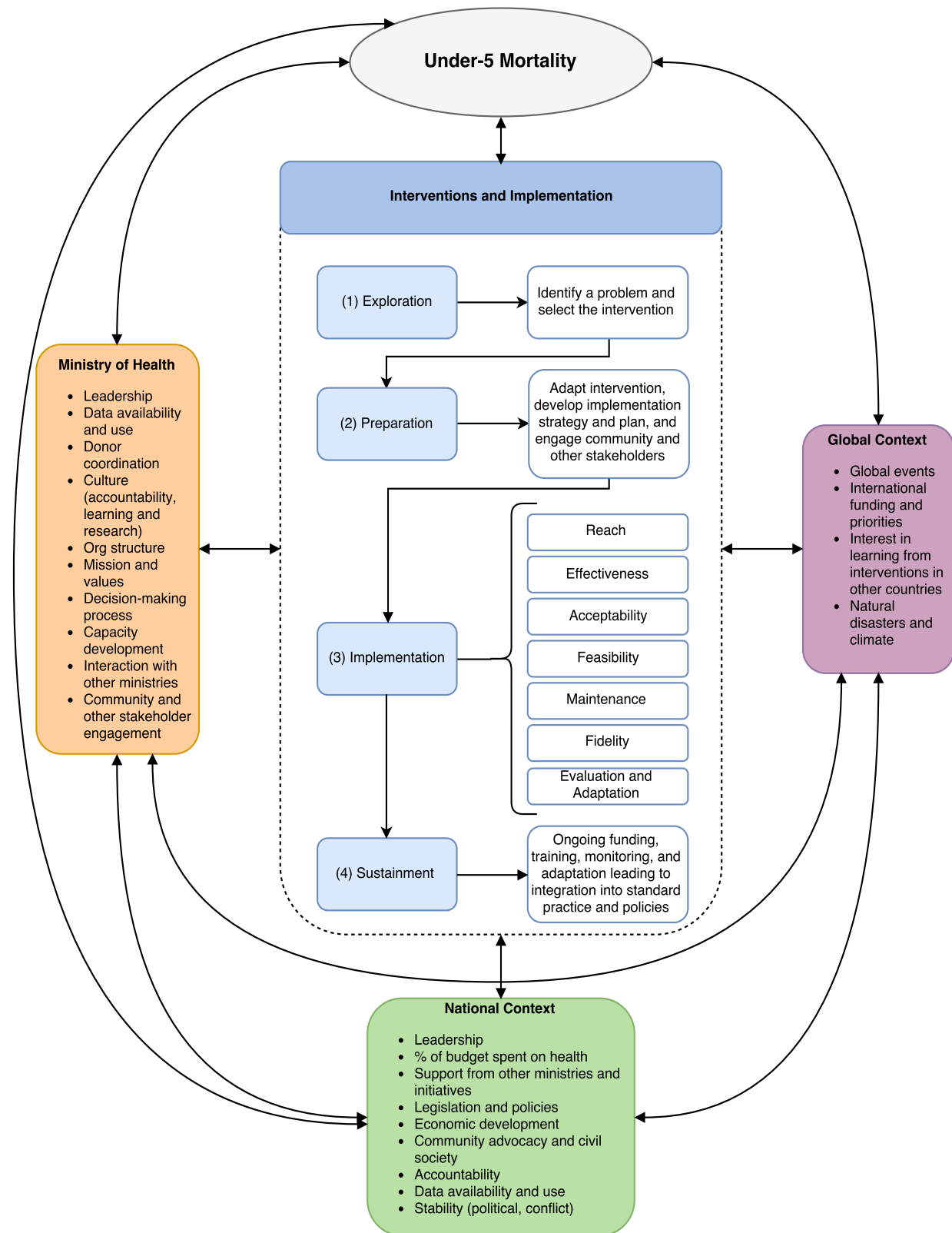
Desk Review (Led by bgC3 with in-depth support from UGHE team)

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 5 exemplar countries defined as countries which have reduced U5 mortality beyond expectations based on regional or resource comparators (see appendix). 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, causes of death, 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 causes of death were limited to those 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)

A more in-depth analysis will be performed for two of the five exemplar countries (Rwanda and a country in Asia TBD) to better understand the decisions, actions, and successes in those countries. Informed by the framework and review of relevant literature on contextual factors and implementation outcomes, we developed core interview guides for 1. Global and national level actors; 2. Ministry of Health actors; 3. project managers and implementers for specific causes of death or EBIs; and 4. other partners. This approach was designed to elicit an explanatory evaluation of the results from the desk review, as well as to identify additional areas of research and to fill identified gaps in understanding. Key informants are chosen based on the topics identified in the desk review and the close collaboration of in-country collaborators, prioritizing those EBIs which were reported as most successful as well as any major EBIs for which no evidence of implementation was found. The interviews are designed to address the intervention implementation process, from decision through implementation to sustainment. This includes critical contextual factors at the relevant global, national, ministry, and local levels. The interviews will also identify additional sources of data and information which could be added to the knowledge base and understanding already developed from the desk review.

The exploratory work to explain the reductions in U5M will be reviewed and approved by the relevant regulatory agencies at the national level. This work is not considered human subjects research as individuals will not be identifiable in any of the dissemination products, and all tapes and notes will be kept in a secure online folder. No names or quotes will be used without explicit permission from the interviewee. Interviewees will be asked for consent for the interview and for recording. At least 2 note takers will be present in person or by phone. Following the interview, LH and/or CB will extract key steps and themes

from the interview in the focused area using the framework. It is expected that over time, as new themes emerge, the framework will also evolve. Due to resource constraints, no formal coding through qualitative analytic software and no attempt to reach saturation is planned.

Analysis and Synthesis

The UGHE team used a mixed methods explanatory approach, applying the framework to understand the progress (or lack thereof) for each cause of death, including choice of and implementation of EBIs (drawing from EPIS), as well as facilitators and barriers at the local, national and global levels (drawing from CFIR) and reflect on available reports of both coverage and mortality changes. This approach aims to create a better understanding of what, how and why the targeted countries were able to achieve success in decreasing U5M. This work will also be 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. For the two in-depth countries, this work will include qualitative analysis and synthesis of the key informant interviews, desk research results, and additional resources identified relevant to the understanding of pathways and work to reduce U5M. For the desk review-only countries, we will explore to the limits of available information the pattern of EBIs chosen, implementation successes, and broader lessons learned to add to the knowledge base. If resources and time allows, we may try to do a limited number of targeted phone interviews if major gaps in knowledge in implementation and context are missing.

During the work to analyze the data from each country and compile the results into case studies, we will begin to categorize cross-cutting themes and lessons. These may be across countries overall or within specific cause of death and EBI work. These results will be summarized into a cross-country report, along with recommendations for next steps in dissemination and potential further explanatory exemplar work in other countries.

Final Products

The work done by UGHE and bgC3 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) two in-depth case studies of exemplar countries using primary and secondary research, (3) summaries of desk research on reductions of U5M in three other exemplar countries, and (4) a cross-country synthesis of insights from all five exemplar countries. Although many 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 five 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 bgC3 to highlight actionable lessons from exemplar countries on a variety of health topics.

APPENDIX B

HOW DOES RWANDA RUN PROGRAMS USING IMPLEMENTATION SCIENCE?

Lisa R. Hirschhorn[1,2], Agnes Binagwaho[1,2,3,4]

1 Northwestern University Feinberg School of Medicine, Chicago, Illinois, United States of America, 2 University of Global Health Equity, Kigali, Rwanda 3 Harvard Medical School, Boston, Massachusetts, United States of America 4 Dartmouth University Geisel School of Medicine, Dartmouth, Hanover, New Hampshire, United States of America

This document outlines a step-by-step how to for systems implementation and improvements based on research and evidence. With the consideration of adaptive management and learning systems with strong legal framework (such as laws and policies guidelines curricula for education), a standardized implementation framework is outlined. This framework highlights the importance of responsibility and accountability from all key players, systematic monitoring and evaluation (M&E) to identify and analyze failures, room for improvement, and efficiencies, as well as an evidence-based approach from start-up and throughout.

STEP ONE: EXPLORATION USING DATA, RESEARCH, AND EVIDENCE
- Identify the need.
- Identify key stakeholders and start the process of informing and engaging.
- Conduct research to:
  - Quantify the needs and underlying causes;
  - Quantify the impact of the need including human, developmental, and financial consequences.
- Conduct research on how to address the need and to plan with evidence:
  - Review published evidence and global guidelines; field assessment and interviews, design new research where there are no identified relevant Evidence Based Interventions (EBIs);
  - Stakeholder engagement and input (community, financial and technical support of donors/partners, in the health sector and other sectors).
- Identify the interventions that can address the need for integration into existing national systems, providing that category of services and information systems.

STEP TWO: PREPARATION USING EVIDENCE
- Choose the evidence-based intervention(s) that are the best fit for the health sector at that moment:
  - Matching need, potential desire, impact, feasibility, and acceptability (fit);
  - Include projections of the expected cost, timeframe, expected human, developmental or financial impact of each intervention;
  - Gather stakeholder input around consensus-building to ensure national trajectory is followed and that the goal and targets are achieved from the Rwandan Government leadership.
- Identify the budget and resources needed (such as equipment, infrastructure, health worker, training, etc.).
- Develop an implementation strategy with a clear definition that is the responsibility of all stakeholders to uphold and inform all those concerned through technical working groups (TWGs) and other coordinating platforms.
- Develop evidence-based guidelines and a legal framework for accountability.

- Plan for M&E-framework, indicators, and systems.
- Test interventions locally:
  - Determine the feasibility and acceptability of the study.
    - Can it be implemented?
    - Are initial changes seen?
    - Do we need to adjust after the test?
    - Do we have to abandon for an evidenced identified reason?
- Plan for sustainability before you start:
  - Policies, laws, curricula for in-service education, regulation, and financial needs up to the test phase and later for the implementation at scale and sources. (Important to start because waiting for sustainability is a pretext for status quo)

STEP THREE: INITIAL IMPLEMENTATION NATIONALLY (A NATIONALLY HARMONIZED WAY TO IMPLEMENTATION)

- Disseminate implementation strategies to all those concerned through TWGs, coordination, and decision-making platforms.
- Train personnel on intervention and implementation, as well as all stakeholders (especially in the community) on engagement/sensitization.
- Implement intervention based on guidelines.
- Develop an accountability framework to assess.

STEP FOUR: SUSTAINMENT THROUGH ADAPTATION, MONITORING, AND INTEGRATION

DATA DRIVEN AND EVIDENCE-BASED ADAPTATION

- Determine if gaps exist in implementation and impact:
- Conduct regular reviews of M&E data and reviews of beneficiaries as well as services providers.
- Do an evaluation to determine where more changes are needed for improvement and efficiencies, and why.
- Conduct ongoing research to identify new and better evidence-based interventions and advances in science for repeat exploration with preparation to adapt, add or replace.
- Adapt continuously to changes in policy, implementation approaches, interventions, and identify new resources needed.
- Disseminate changes and support with ongoing training, sensitization, policies and needed system changes.
- Continuously revise the implementation.
- Regular ongoing evaluations of M&E, data, and evidence-driven adaptations.

INTEGRATION AND SYSTEMS SUSTAINABILITY

- Continue ensuring funding in national budget and/or through donor support.
- Cultivate a culture of evaluation and implementation of needed changes to ensure that this approach becomes "business as usual".
- Integrate training and capacity-building in pre-service education, in day to day citizen interactions, and in professional lives.