



# Applying Quality Improvement Approaches to Reduce Mother-to-Child HIV Transmission and Improve Health and Nutrition Care in Five Countries: Lessons from the Partnership for HIV-Free Survival

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## Abstract

The World Health Organization guidelines for treating pregnant HIV-positive women and preventing HIV transmission to infants now recommend lifelong antiretroviral treatment for pregnant and breastfeeding women. We applied quality improvement (QI) methods to support governments and facility staff to address service gaps in 5 countries under the Partnership for HIV-Free Survival (PHFS). We used 3 key strategies: break the complex problem of improving HIV-free survival into more easily implementable phases, support a national management team to oversee the project, and support facility-level staff to learn and apply QI methods to reducing mother-to-child transmission. The key results in each country were increases in data completeness and accuracy, increases in retention in care of mother–baby pairs (MBPs), increase in coverage of MBPs with appropriate services, and reduction in vertical transmission of HIV. The PHFS experience offers a model that other multicountry networks can adopt to improve service delivery and quality of care.

## Keywords

quality improvement, PMTCT, option B+, nutrition, infant and young child feeding

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### What Do We Already Know about This Topic?

Quality improvement (QI) has been shown to be effective in reorganizing care to improve services for HIV-positive women and their exposed infants and to reduce transmission from mother to infant.

### How Does Your Research Contribute to The Field?

We applied the QI approach to address the same problems in five countries and documented what each country did to reorganize service delivery and improve clinic processes.

### What Are Your Research's Implications Toward Theory, Practice, or Policy?

The Partnership for HIV-Free Survival intervention changed practices in health facilities and contributed to changes made in national policy that were a direct result of what was shown to be effective in improving care for mothers and their infants.

## Introduction

The World Health Organization (WHO) guidelines for treating pregnant HIV-positive women and preventing HIV infection in infants have evolved since 2010 to now endorse lifelong antiretroviral treatment (ART) regardless of clinical stage or CD4 count for pregnant and breastfeeding women.<sup>1</sup> This change required health-care providers to modify care delivery by initiating all HIV-positive pregnant women on ART; supporting treatment adherence during and after pregnancy; counseling women on breastfeeding and complementary feeding, weaning, and postweaning testing; providing prophylaxis for HIV-exposed infants (HEIs); and treating HEIs who become infected. Already overburdened, many providers struggled to effectively handle these changes, leaving significant service delivery gaps.<sup>2</sup>

To address these challenges, the WHO, the United Nations Children's Fund, and the US President's Emergency Plan for AIDS Relief (PEPFAR) launched the Partnership for HIV-Free Survival (PHFS) in March 2013, supporting Kenya, Lesotho, Mozambique, South Africa, Tanzania, and Uganda. This article described the application of quality improvement (QI) methods in 5 of the 6 countries. Although the global initiative began in 2013, the various countries were on a staggered time line, according to their differing situational contexts. The PEPFAR funded 2 technical assistance teams: USAID Applying Science to Strengthen and Improve Systems Project (ASSIST) in Kenya, Lesotho, Tanzania, and Uganda, and the Institute for Healthcare Improvement (IHI) in South Africa to support governments and health facility staff in applying QI approaches to

address service gaps (note 1). In every country, the Ministry of Health (MoH) took leadership of the initiative, and implementing partners provided inputs such as clinical training, supplies, and community referrals.

## Problem

Without ART prophylaxis for mother–baby pairs (MBPs) and breastfeeding for 2 years or longer, mother-to-child transmission (MTCT) risk is approximately 40% for HEI.<sup>3</sup> Combined ART administered during pregnancy and continued while breastfeeding, along with appropriate care, can reduce MTCT to less than 5%.<sup>4</sup> But there are many challenges, and transmission rates remain unacceptably high in resource-limited countries.<sup>5,6</sup>

An HIV-positive pregnant woman and her infant require multiple stages of coordinated care for their optimal health, from preconception until the infant is 2 years old. Many health systems fail to support MBPs to transfer among these different stages of care, creating multiple opportunities for a health facility to lose track of MBPs who simply do not return for care<sup>7</sup> or for a pair to receive only one category of services without being connected to other services they need. Retention is a problem across HIV care, but pregnant women are more likely to be lost to follow-up (LTFU) than nonpregnant adults.<sup>8</sup> Retention progressively decreases from predelivery into the postpartum period.<sup>9</sup>

The PHFS promoted the use of QI methods to address many of these problems stemming from how care is organized. Quality improvement is a management science that empowers front-line health workers with skills and tools to function as a QI team to change systems and processes of care at health facility level. Quality improvement has been shown to improve PMTCT and other care processes in health facilities.<sup>10,11</sup>

## Ethical Approval and Informed Consent

No ethical approval or informed consent was required for this paper as no patient-level data were collected and used.

## Methods

Kenya, Lesotho, South Africa, Tanzania, and Uganda implemented PHFS-supported work based on 3 key strategies: (1) break the complex problem of improving HIV-free survival into more easily implementable phases, (2) support a national management team to oversee the project, and (3) support facility-level staff to learn and apply QI methods to reducing MTCT. During implementation, the 4 USAID ASSIST-supported countries (Kenya, Lesotho, Tanzania, and Uganda) collaborated by sharing results and learning among the 4 countries, while the South African team supported by IHI worked independently.

**Table 1.** Retention Denominator Options, Strengths, and Weaknesses.

Country	Denominator	Data Source	Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Kenya</li> </ul>	<ul style="list-style-type: none"> <li>Population estimate (# of HEI expected to be in care based on prevalence)</li> </ul>	<ul style="list-style-type: none"> <li>NA (based on epidemiological modeling)</li> </ul>	<ul style="list-style-type: none"> <li>Easy to calculate</li> <li>No cost</li> <li>Comprehensive</li> <li>Supported by policymakers</li> <li>Helpful when spreading to other districts</li> <li>Helpful with data validation</li> <li>Denominator remains constant</li> </ul>	<ul style="list-style-type: none"> <li>Imprecise (overlapping catchment areas)</li> <li>Confusing for people at the facility level (too abstract)</li> <li>Sites may have difficulty determining this number</li> <li>Does not consider community-specific characteristics in different parts of the country</li> <li>Not part of the routine monthly indicators on the national health information system</li> </ul>
<ul style="list-style-type: none"> <li>Uganda</li> <li>Lesotho</li> <li>Tanzania</li> <li>South Africa</li> </ul>	<ul style="list-style-type: none"> <li># of exposed infants from postnatal care (PNC) only (first contact with infant is during PNC)</li> </ul>	<ul style="list-style-type: none"> <li>EID register (Uganda/Tanzania)</li> <li>Under-5 register (Lesotho)</li> <li>Mothers' chronic care ART cards (Lesotho)</li> <li>PNC register (South Africa)</li> </ul>	<ul style="list-style-type: none"> <li>Easy to enroll patients</li> <li>Researchers and policymakers support because the denominator is precise and concrete</li> <li>Gives a broader picture for retention as opposed to using only the appointment book</li> </ul>	<ul style="list-style-type: none"> <li>Complex</li> <li>May exclude mothers and infants who came for antenatal care or delivery but not PNC</li> <li>In some cases, inconsistent documentation may mean some HEI are not enrolled/counted (Lesotho)</li> </ul>

Abbreviations: ART, antiretroviral treatment; HEI, HIV-exposed infant; NA, not available.

### *Break the Complex Problem of Improving HIV-Free Survival into More Easily Implementable Phases*

Given the complexity of HIV care for women and their infected newborns, we deconstructed the problem into a set of smaller problems to be tackled by teams sequentially. We believed setting more manageable goals and achieving short-term, intermediate successes would motivate QI teams. In each country, the national management team designed the intervention to first understand service flow and data availability in a few clinics that would be supported under the PHFS. They learned that many patients and their data were lost between different service areas (eg, obstetrical care and HIV care) and that facilities were not able to link the records of mothers with their infants. They found that even during clinic visits, MBPs often did not receive all elements of required care. Staff from the 4 ASSIST-supported countries met to share their findings and plan how to phase the work. During this meeting, they agreed to break improvement efforts into 3 phases:

- Retain MBPs in care to avoid postpartum LTFU.
- Provide critical services at routine visits for MBPs.
- Provide critical services at special visits for MBPs.

The South African team began by sensitizing demonstration districts and province staff on the PHFS and conducting

12-month retrospective baseline assessments of services provided to HIV-positive mothers and their exposed infant in the 54 demonstration sites to identify gaps in PMTCT service delivery. They arrived at similar conclusions. After developing this phased approach, technical assistance teams worked with national management teams to develop implementation plans.

*Keeping MBPs in care to avoid postpartum LTFU.* One of the first implementation challenges to overcome for keeping MBPs in care was measurement. Teams needed to measure the number of MBPs retained in care (numerator) using the denominator of the total number of MBPs who should be attending the clinic every month. But there is no global standard for this indicator, given different country guidelines and data systems. All PHFS countries measured the numerator in the same way; the problem was how to calculate the number of MBPs who should be retained in care. We settled on 2 options for measuring this denominator with different strengths and weaknesses (Table 1). Each country team selected the option that worked best for them.

A key challenge in understanding the problem's scope was determining accurate measures for the number of MBPs who *should* be in care versus those *actually* in care. Each country team field-tested their selected indicator at one site before collecting baseline data for all sites. In Uganda, the baseline

**Table 2.** Routine and Special Visits.

Critical Services	
Routine visit	
Every visit	<ul style="list-style-type: none"> <li>• General history, physical, and management of acute issues (vital signs and screening for opportunistic infections)</li> <li>• Adherence support for mothers on ART</li> <li>• Nutrition assessment, categorization, and support for mothers and infants</li> <li>• Drug provision for mothers and infants (ARV for mother and infant, co-trimoxazole for infant only)</li> <li>• Counseling/information on infant and young child feeding</li> <li>• Family planning counseling and uptake</li> <li>• Set appointment for next visit</li> <li>• Immunization (Lesotho)</li> </ul>
Special visits	
6-week visit	<ul style="list-style-type: none"> <li>• Early infant diagnosis</li> <li>• Dried blood spot (DBS) test/DNA-PCR test</li> <li>• Stop nevirapine syrup provision</li> <li>• Begin co-trimoxazole syrup provision</li> <li>• Link positive infants with treatment</li> </ul>
6-month visit	Begin complementary feeding
12-month visit	Make decision about breastfeeding based on guidelines
18-month visit	HIV test for baby
Postweaning visit	HIV test for baby

Abbreviations: ART, antiretroviral treatment; PCR, polymerase chain reaction.

measure at 22 demonstration sites was 2.2% in care, translating to over 97% of HEI unaccounted for. Baseline was 0% to 18% in care at 30 Tanzania sites, 0.8% in care at 16 sites in Kenya, and 1% in care at 12 Lesotho sites.

Infants born at each site up to 18 months prior (24 months in Lesotho) were counted to create an estimated denominator. For example, to determine the total number of HEIs younger than 18 months expected to be in care monthly, Uganda used their early infant diagnosis register to identify all HEIs registered up to 18 months prior to the month of interest, then removed all infants who had died, been discharged, or transferred out of the facility, leaving only active HEIs and those LTFU. Monthly, sites adjusted the denominator by adding newly enrolled HEIs and transfers-in and deducting the dead, discharges, and transfers-out.

*Providing critical services at routine and special visits.* Retaining MBPs in care is necessary but not sufficient to improve HIV-free survival. When MBPs come to a health facility, they also need to receive the appropriate services. One of the challenges in providing care to MBPs is that the appropriate services change depending on the age of the child. This makes it confusing for health workers to remember what to provide on that specific visit. To address this problem, we divided elements of

care into routine care—those elements of care that were required for any interaction with MBPs—and special care—those elements of care that would vary depending on the child’s age or the mother’s clinical status (Table 2). Countries measured routine care service provision differently. Lesotho and Uganda used a composite indicator; Kenya and Tanzania measured and tracked each service separately. The composite indicator numerator consisted of 7 items in Uganda listed in Table 2 under critical services; Lesotho tracked an eighth item, immunization. If all services on the list were provided, the MBP was counted in the numerator.

After addressing retention, QI teams within facilities focused on improving care during routine visits and then moved on to improving special visits. The idea behind this phased approach was to avoid overwhelming QI teams with too many improvements areas at once.

### *Supporting a National Management Team to Oversee the Project*

For the second element of the PHFS strategy, each country established a PHFS steering group and/or used their existing national PMTCT working group to (1) designate demonstration sites for piloting this approach, (2) identify improvement priorities and measures, (3) coordinate the roles and responsibilities of each partner, and (4) plan and oversee implementation. Groups convened monthly and were chaired by an MoH PMTCT lead and, in some countries, co-chaired by the nutrition lead. The initial step was to identify demonstration sites (Table 3) and to plan how to use the learning from these sites to develop a strategy to scale up the approach nationally if it was found to be effective.

### *Support Facility-Level Staff to Learn and Apply QI Methods*

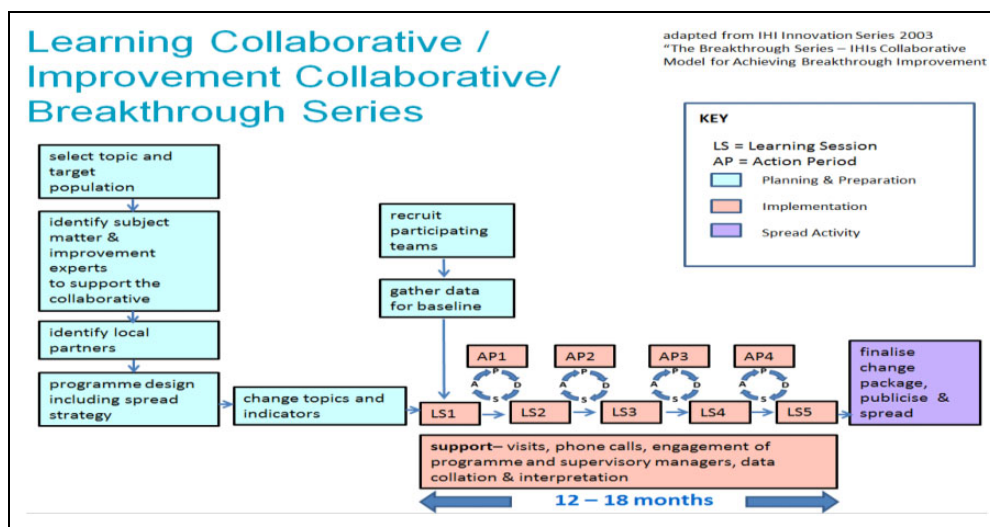
The heart of the PHFS work was changing how care was delivered at facilities. We used 3 approaches to support facility staff to use QI methods to improve care for HIV-positive mothers and their babies: initial training in QI methods, on-site QI coaching, and peer-to-peer learning.

*Initial training.* Two- or 3-day QI trainings<sup>12,13</sup> were conducted by advisors with at least 5 years’ experience applying QI methods to different clinical areas, except for Lesotho staff who were newer to the QI approach. Topics included how to form QI teams at the facility, developing improvement aims (clear and quantifiable objectives), analyzing clinic processes to identify gaps, choosing changes and testing them using the Plan-Do Study-Act (PDSA) cycle, and analyzing data to determine whether a change resulted in improvement to a predetermined process indicator. During the QI training, advisors introduced health workers to tools that guided teams through implementation. Teams in Kenya, Lesotho, Tanzania, and Uganda used QI documentation journals,<sup>14</sup> while teams in South Africa used QI trackers, hardcover books, and PDSA templates.<sup>15</sup> Teams

**Table 3.** PHFS Demonstration Sites by Country and Facility Type.

Country	# of Districts	Hospitals	Health Center III (Subcounty Facility)	Health Center IV (County Facility)	Total Number of PHFS Demonstration Sites	Technical Assistance Team
Kenya	1	3	7	6	16	USAID ASSIST
Lesotho	3	3	N/A	9	12	USAID ASSIST
South Africa	3	0	N/A	54	54	IHI
Tanzania	3	7	14	9 (dispensaries)	30	USAID ASSIST
Uganda	6	3	7	12	22	USAID ASSIST

Abbreviations: ASSIST, Applying Science to Strengthen and Improve Systems; N/A, not applicable; PHFS, Partnership for HIV-Free Survival; USAID, US Agency for International Development.

**Figure 1.** The Institute for Healthcare Improvement quality improvement collaborative model.

used these tools to document progress, record data, and plot time series charts; these tools were reviewed during coaching visits. Country teams' application of QI was guided by the *Model for Improvement*.<sup>16</sup>

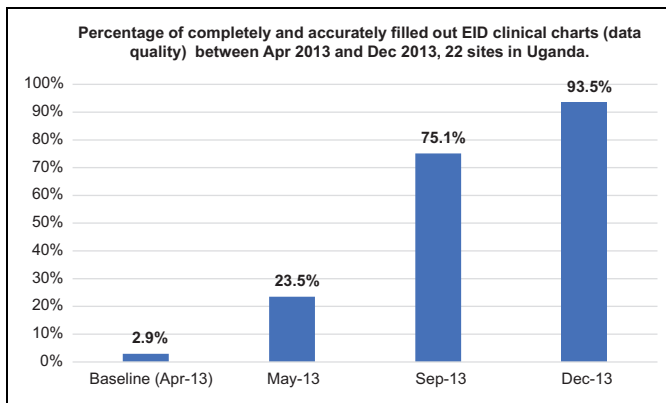
**Coaching.** The teams received regular coaching led by MoH district health officers competent in QI, as well as advisors from the technical assistance teams. The MoH officers attended the initial QI training and received ongoing guidance from QI advisors where needed, essentially a "coaching for coaches." Coaches supported the facility staff to learn how to work effectively as a QI team, identify the root causes of barriers to improving care, develop possible solutions for those barriers, use iterative testing to identify which solutions work and modify them to work optimally in that context, and continually measure and use data as feedback on whether care was improving.

In Kenya, Uganda, and South Africa, sites received monthly coaching. Due to the distances between the 3 Tanzanian districts (Mufindi, Nzega, and Mbeya), sites received quarterly coaching. Visits in Lesotho occurred every quarter from March 2014, then monthly beginning in August 2016. Coaches in Kenya, Lesotho, Tanzania, and Uganda used a coaches' guide,<sup>17</sup> and in South Africa, an improvement

tracker,<sup>18</sup> to organize their visits by documenting improvement aims, change ideas that were being currently tested, results from previous coaching visits, and areas to discuss during the next visit. Coaches also collected data from facilities on paper before transferring them to Excel databases for aggregation and analysis.

**Peer-to-peer learning.** The QI collaborative model (Figure 1), developed by IHI, was applied in each country. This is a method for testing and implementing evidence-based changes quickly across a group of facilities.

Two to 3 individuals from each demonstration site were convened for 2-day district-level learning sessions every quarter. The technical assistance team led the development of learning session agendas, created graphs depicting site performance, identified roles for district management coaches and implementing partners at the sessions, and prepared materials (flip charts, markers, notebooks, etc). Learning sessions begin with presentations of site-level performance data, which often ignited friendly competition among teams. These gatherings also often included small group discussions to identify good practices, technical or QI method refresher training, and development of action plans by each team. After each session,



**Figure 2.** Improving data completeness and accuracy in Uganda.

participants shared what they learned with their colleagues. Team members rotated their attendance at the next session so that most, if not all QI team members, participated in at least 1 learning session. The PHFS learning session participation ranged from 25 to 50 people, depending on the number of demonstration sites in the district.

## Results

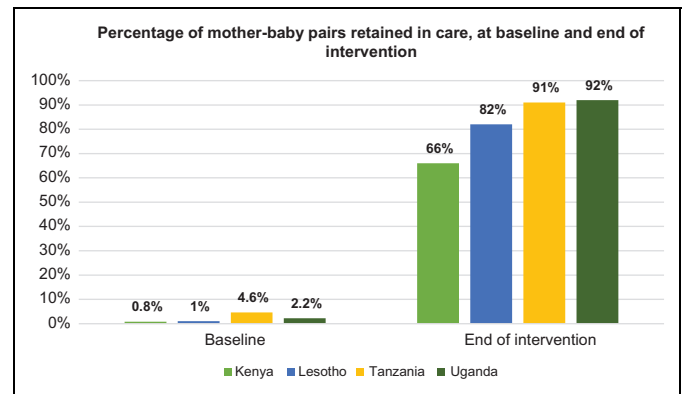
The key results of PHFS activities in each country were increases in data completeness and accuracy, increases in retention in care of MBPs, increase in coverage of MBPs with appropriate services, and reduction in vertical transmission of HIV. This article presents the first 2 types of results; service coverage and MTCT results are presented in other articles in this supplement.

### Improving Data Completeness and Accuracy

In Kenya and Tanzania, data quality audits were conducted during coaching visits, and data cleaning exercises were undertaken to address gaps. In South Africa, teams conducted file audits and cross-checked tally sheets, facility input forms, registers, and DHIS data monthly to ensure accuracy and to identify and address inconsistencies in the data.

In Uganda, data accuracy and completion was a QI aim. At baseline in Uganda, only 2.9% of HEI clinical charts were found to be complete and accurate. Quality improvement teams improved the completeness and accuracy of records to over 90% within 9 months and maintained that level of performance for the subsequent 9 months before they ceased regularly tracking this indicator (Figure 2).

The Ugandan teams first discussed how they would measure improvement in data completeness and accuracy. They agreed to tally the number of records with complete and accurate data and the total number of records at the end of each day, determining accuracy by cross-checking patient records against registers. A QI team member was assigned to perform this task, and teams met briefly each day to review the results. After a root cause analysis, they learned that many health workers were unclear about how to complete the registers and records and required refresher training or orientation on proper documentation of



**Figure 3.** Improving retention of mother-baby pairs in 4 countries.

services. Training only resulted in slight improvements since the problem was both due to lack of understanding how to document and failure to do it. The QI teams agreed that clinical records needed to be completed before patients left the clinic, and they assigned a nurse with the task of checking each record.

### Keeping MBPs in Care to Avoid Postpartum LTFU

Providers worked to reorganize and integrate care delivery by merging service points for MBPs, which ensured they could link the files of mothers and their babies and give pairs a joint appointment date. Improving retention also included ensuring that MBPs accessing other services at the facility (like for fever) were identified and given HIV/MNCH appointments. Several tools and job aids were created and used to track pairs.

The proportion of MBPs retained in care every month was extremely low at baseline, but the 4 country teams (Figure 3) were able to significantly improve retention by the end of their respective intervention periods. This supplement includes individual country papers describing the QI work in Kenya, Lesotho, Tanzania, and Uganda, respectively; those papers provide in-depth process results using time series charts. Uganda collected data from 3 non-PHFS sites for comparison; those sites did not register any change in the processes that were being improved at demonstration sites.

The South African technical assistance team faced challenges combining MBP files. Joint appointments were given, but files ultimately remained separate. The team identified HIV-positive pregnant women at antenatal care and used post-natal care (PNC) registers to identify HEIs. Pairs were documented in another book. This exercise proved helpful; HEIs were easily identified at the 6-week PNC visit and received care. However, follow-up visits were challenging because up to 60% of mothers resumed working and their HEIs were brought to facilities by guardians. Despite numerous appointment reminders, most mothers did not return. For PHFS, South African teams only counted mothers and babies who received care as pairs in their numerator and total number of MBPs in their denominator. Results from South Africa were not provided for this manuscript.

**Table 4.** List of Changes Tested and Adopted to Improve data Completeness and Accuracy.

Change Ideas	Countries Tested
On-the-job training for staff on proper documentation of records	Kenya, Lesotho, South Africa, Tanzania, Uganda
Staple mother and baby cards together	Kenya, Lesotho, Tanzania, Uganda
Records completed immediately before MBPs leave the facility	South Africa, Tanzania, Uganda
Staff reviews data tools and provides feedback on completeness and accuracy before the MBP leaves the clinic	South Africa, Tanzania, Uganda
Assign one staff member with the role of finding/reviewing incomplete records	Tanzania, Uganda
Paste reminders on wall for clinicians to remember to fill out records	Uganda

Abbreviation: MBP, mother–baby pair.

### *Providing Critical Services at Routine and Special Visits*

All countries improved services at routine and special visits, including nutrition services and HIV testing for HEIs at various stages. Detailed results are available in the country-specific papers within this supplement.

Countries inserted checklists into medical records and posted them on examination room walls to ensure that MBPs received all required services when they came for care.

### *Specifying Changes to Service Delivery That Were Tested and Found Effective*

In addition to the quantitative results, PHFS activities in the 5 countries generated important learning about how to improve PMTCT in these settings. Tables 4 to 7 list the changes tested and adopted in the 4 main areas that QI teams focused on: data completeness and accuracy, retention of MBPs, increasing coverage of routine services, and increasing coverage of special services. (The article titled “Using a multi-country learning network to harvest and rapidly spread implementation knowledge across programs aimed to reduce mother-to-child transmission of HIV and improve nutrition: perspectives and lessons learned for similar large-scale initiatives” in this supplement describes how this learning was generated.)

The country papers included in this supplement (Kenya, Lesotho, Tanzania, and Uganda) describe in detail the changes they tested. Each country and even each facility team discussed how best to improve processes and decided on which changes to test at a microlevel. For that reason, not every country tested every change, because a given change may not be relevant in certain health-care settings. In fact, only a handful of changes that resulted in improvement were tested in every country. A change idea may not have been relevant because it was addressing an issue that was not a problem in that particular context, or because it was not a

**Table 5.** List of Changes Tested and Found Effective to Increase Retention of MBPs.

Change Ideas	Countries Tested
MBP seen together in clinic on same appointment date/time	Kenya, Lesotho, Tanzania, South Africa, Uganda
Priority given to MBPs when they come to the clinic	Kenya, Lesotho, Tanzania, Uganda
Instead of having mothers and babies move from service to service for consultation, provide all services in the same consultation room	Lesotho
Write next appointment date on medicine bottle	Uganda
Staple or clip MBP cards together	Kenya, Lesotho, Tanzania, Uganda
Write appointment date/time on mother’s clinic card or baby’s clinic card	South Africa, Tanzania
Create improvised MBP register using a notebook	Kenya, South Africa
Give MBP just enough drugs to last until next appointment	Tanzania, Uganda
MBPs to be seen that week are sorted in advance and files kept aside; after the MBP attends that week, the file is restored. At the end of the period, the remaining files represent pairs who did not turn up for their appointments, and the staff follow-up.	Kenya
Expert patients follow-up with lost mothers and mothers who miss appointments	Kenya, Tanzania, Uganda
Provide special clinic day for mothers and children (families) to be seen together	Kenya, Tanzania, Uganda
Use mentor mothers to support, trace, counsel, and return MBPs to care	Kenya, Tanzania, Uganda
Phone calls to remind mothers about appointment	South Africa, Tanzania, Uganda
Update register daily to detect missed appointments	South Africa, Tanzania
Engage community health workers (CHWs) and home-based care workers to track MBPs that missed appointments	South Africa, Tanzania
Involve male partners by encouraging them to attend MBP appointments	Tanzania, Uganda

Abbreviation: MBP, mother–baby pair.

good solution for that particular country/facility. Each country’s experiences with the various changes tested were shared through biweekly calls and multicountry learning network channels.

## **Discussion**

Retaining MBPs in care to reduce vertical transmission requires making the service delivery system easier for patients

**Table 6.** List of Changes Tested and Adopted to Increase Coverage of Routine Services.

Change Ideas	Countries Tested
Merge the EID and ART clinic services to see MBPs in one place	Kenya, Lesotho, Tanzania, Uganda
Services moved from ART clinic to MCH clinic to decongest ART clinic and reduce waiting times	Kenya, Lesotho, Tanzania, Uganda
Assign specific staff roles in the clinic so all services are provided	Kenya, Lesotho, Tanzania, Uganda
Dispense MBP drugs in the clinic	Kenya, Lesotho, Tanzania, Uganda
To strengthen linkages, accompanied referral of MBPs from all entry points	Kenya, Lesotho, Tanzania, Uganda
On-the-job orientation on infant and young child feeding counseling and nutrition assessment	Kenya, Lesotho, Tanzania, Uganda, South Africa
Mothers informed about services to expect so can remind health workers	Uganda
Promotion of exclusive breastfeeding through on-going counseling by CHW during home visits	South Africa
Use of breastfeeding buddies (fellow mothers who are practicing or recently practiced exclusive breastfeeding in the same area/locality)	South Africa
Open days with breastfeeding competitions on proper positioning/latching and knowledge quizzes	South Africa

Abbreviation: ART, antiretroviral treatment; CHW, community health worker; EBF, EID, early infant diagnosis; MBP, mother–baby pair; MCH, maternal and child health.

to remain in care and reliably providing the right care to patients at each visit. Both present challenges to a health-care system. First, health-care service delivery is typically an individual activity (eg, the nurse is responsible for one set of tasks, while the doctor has another set). Retention does not fit this paradigm—no one individual is responsible for ensuring people stay in care. Second, relying on individuals' memory about which services should be provided at each visit is fraught with the possibility of error. Quality improvement is a collective management approach that can give health workers better skills and tools for fixing problems like retention—areas that are not easily assignable to any one person—and for changing service delivery, making it less dependent on individual initiative or memory.

Breaking addressing problems down into 3 stages, a focus on country ownership, and a collaborative country-level steering group allowed countries and QI teams to quickly get started.

From the very first meeting, we agreed to a deliberate focus on learning and documenting what health workers were learning in real time. The ASSIST technical support teams in particular held biweekly phone learning meetings to discuss progress, successes, and challenges. Throughout the 3-year implementation period, this deliberate focus reminded us to continuously analyze, document, and share what we were learning about

**Table 7.** List of Changes Tested and Adopted to Increase Coverage of Special Services.

Change Ideas	Countries Tested
Use of a pregnancy screening tool at facility with immediate antenatal booking, providing early diagnosis and initiation of ART	South Africa
Pregnancy screening in community by CHWs with referral to antenatal care for early booking	South Africa
Date of next HIV testing documented in MBP booklet/passport and books sorted at reception. Infants tested every 3 months unless confirmed positive	Kenya, Uganda
Clinical training and onsite mentorship to health workers	Kenya, Lesotho, South Africa, Tanzania, Uganda
Expedited visits for pregnant women and MBPs to reduce waiting time	South Africa
List of mothers who need to be retested generated and checked each clinic day using reminders like color-coded stickers, pregnancy wheel (due date calculator), and so on	South Africa, Tanzania, Uganda
CHWs track MBPs who miss appointments	Kenya, South Africa, Tanzania, Uganda
Prioritizing availability of HIV test kits for the maternal and child health (MCH) clinic	Uganda
Health workers reoriented on use of test status codes and their interpretations	Uganda
Paste reminders on wall for clinicians to remember to fill out records	Uganda
Generate list of expected infants; make a note in the EID register	South Africa, Tanzania, Uganda
Education on importance of postnatal testing	Kenya, South Africa
Collection of dried blood sample for HIV DNA-PCR done in MCH instead of sending infants to lab	Kenya, Tanzania, Uganda
Give mothers an exact appointment date and ask them to return instead of telling them to bring their babies at 6 weeks, 18 months, or 6 weeks after cessation of breastfeeding	Uganda
Phone calls to mothers whose babies miss the test on the appointment date or prior to the appointment to remind them to come	Uganda
Create a column in the EID register to indicate the dates for the final rapid HIV test of the HEI	Uganda

Abbreviation: ART, antiretroviral treatment; CHW, community health worker; EID, early infant diagnosis; HEI, HIV-exposed infant; MBP, mother–baby pair; PCR, polymerase chain reaction.

improving care within each country and across countries, using various formats from one-on-one to multicountry sharing.

There were several challenges in implementation. The international partners charged with facilitating the PHFS in the various countries needed to understand how to work under the



leadership of the MoH to integrate this work into existing national PMTCT strategies. If the PHFS was perceived as a new or parallel intervention, the MoH was rightfully reluctant to engage or assume ownership.

In some cases, we struggled to engage all critical MoH departments (HIV, MNCH, and nutrition) from the start. It was also challenging for us to keep the focus on learning. Several steering committees were in favor of implementing the PHFS in many sites straightaway, and we held dialogues to convince the countries to keep the total number of demonstration sites small in order to facilitate learning, documentation, and validation of effective strategies for eventual spread.

### Country Variation in QI Application

Quality improvement applications are contextual; health-care workers learn to constantly modify and adapt when using QI approaches. Countries agreed on priorities, but their implementation approach varied. Teams varied in how they measured MBP retention as described above and in the provision of their routine visit services. For example, Lesotho and Uganda tracked the delivery of their respective standard care package of services using a composite indicator. Kenya, South Africa, and Tanzania tracked provision of individual routine services rather than a standard package, such as ART initiation for mothers or nutrition assessment and categorization.

Teams tested change ideas according to country contexts, but we found parallels. For example, Kenya used mentor mothers to track mothers who missed appointments; Tanzania used community health workers and home-based care providers; while Uganda used expert patients, linkage facilitators, mentor mothers, or community health workers.

The nuances of coaching and peer-to-peer learning also varied. South Africa, Tanzania, and Uganda had learning sessions quarterly; Kenya had yearly sessions; and Lesotho convened 3 over an 18-month period. South Africa faced challenges as monthly coaching visit dates were preplanned; teams were not able to adapt if the subdistrict had another priority that week. This meant missed opportunities for MoH program coordinators to be part of some site visits.

The various country/facility management teams had divergent abilities and preferences, which led to divergent approaches in the application of QI and the variation in the strength of the results.

Across the 5 countries, PHFS supported 134 facilities to use QI approaches to improve PMTCT, MCH, and nutrition care for MBPs. We believe the PHFS experience offers a model that other multicountry networks can adopt and build on to improve service delivery and quality of care. The key elements of success were: (1) breaking down problems into smaller, more specific problems; (2) addressing those problems with data-driven QI led by individual facility teams; (3) multistakeholder, in-country leadership; (4) on-site QI coaching; and (5) inter- and intracountry shared learning and support. Particular challenges were related to shifting the focus away from excessive planning and data collection at the early stages and keeping the

focus on getting started quickly and learning from the QI processes that each facility was applying to its clinical flow. The application of QI in this context led to greater efficiencies and effectiveness in service delivery.

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