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Investing In HIV Services While Building Kenya's Health System: PEPFAR's Support To Prevent Mother-To-Child HIV Transmission

ABSTRACT **Trade-offs may exist between investments to promote health system strengthening, such as investments in facilities and training, and the rapid scale-up of HIV/AIDS services. We analyzed trends in expenditures to support the prevention of mother-to-child transmission of HIV in Kenya under the President's Emergency Plan for AIDS Relief (PEPFAR) from 2005 to 2010. We examined how expenditures changed over time, considering health system strengthening alongside direct treatment of patients. We focused on two organizations carrying out contracts under PEPFAR: the Elizabeth Glaser Pediatric AIDS Foundation and FHI360 (formerly Family Health International), a nonprofit health and development organization. We found that the average unit expenditure, or the spending on goods and services per mother living with HIV who was provided with antiretroviral drugs, declined by 52 percent, from $567 to $271, during this time period. The unit expenditure per mother-to-infant transmission averted declined by 66 percent, from $7,117 to $2,440. Meanwhile, the health system strengthening proportion of unit expenditure increased from 12 percent to 33 percent during the same time period. The analysis suggests that PEPFAR investments in prevention of mother-to-child transmission of HIV in Kenya became more efficient over time, and that there was no strong evidence of a trade-off between scaling up services and investing in health systems.**

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The President's Emergency Plan for AIDS Relief (PEPFAR) was launched in 2003 and is now in its second phase, spanning 2009–14. As per its five-year strategy, PEPFAR is in a transition from its first phase.[1] The first phase (2003–08) was characterized as a response to an ongoing emergency, with a need to rapidly expand essential services to prevent, treat, and mitigate the effects of the AIDS epidemic in developing countries. In contrast, the second phase is focusing on creating a sustainable response, by strengthening the health systems of countries served. Effective and efficient service delivery in the present also contributes greatly to sustainability, in that they enable services to continue in the future and meet national targets.

Strengthening The Health System In Kenya

PEPFAR's approach to health system strengthening has three core elements: increased country ownership of the HIV/AIDS response, stronger support systems and infrastructure, and im-

proved capacity of health workers at all levels. All three elements contribute to the sustainability of the current response to HIV/AIDS, in that governments increasingly lead in planning, overseeing, and managing the national program, and HIV/AIDS services are delivered in the context of a strong health system. This helps ensure that countries will be able to maintain the program as donor funding moves from a primary to a supplementary role.

THREE CORE ELEMENTS Support for country ownership means that partner countries take on an increasing share of the responsibility for their programs. Greater local government ownership involves government ministries' and departments' taking the lead in planning, operating, and evaluating HIV/AIDS programs. Activities conducted by PEPFAR contractors in a country, known as implementing organizations, also contribute to this via workshops, studies, and stakeholder engagement.

Strengthened support systems and infrastructure includes support for laboratory networks, monitoring and evaluation systems, and logistics chains for commodities such as antiretroviral drugs and test kits for pregnant women and infants.

Enhanced capacity building includes strengthening the competencies of individuals and institutions in the planning, logistics, and evaluation functions within HIV/AIDS programs. It also entails strengthening and expanding the clinical workforce that provides direct treatment to patients.

HEALTH SYSTEM STRENGTHENING VERSUS SERVICES FOR HIV/AIDS Trade-offs may exist between investments to promote health system strengthening, such as investments in facilities and training, and the rapid scale-up of HIV/AIDS services. For example, the US government has committed to increasing the number of people living with HIV/AIDS whom it supports on antiretroviral treatment globally from about 3.9 million at the end of 2011 to 6 million at the end of 2013—an increase of 53 percent.[2] As stated in recent policy documents, a balance will need to be struck between investments in health system strengthening and the expansion of service provision to meet the remaining need.[3]

FINDING THE RIGHT BALANCE In this article we provide quantitative and qualitative evidence for policy makers about this balance. We concentrate on the financial implications of PEPFAR investments to support the provision of services as well as the strengthening of health systems. We use a case-study approach, analyzing the evidence in a specific country and with a specific intervention: the prevention of mother-to-child transmission of HIV in Kenya.

We pursued answers to the following questions: What has been the trend in PEPFAR's investment in the intervention in Kenya? How did PEPFAR's focus in investments change over time and across the two domains of provision of HIV/AIDS services and health systems strengthening? How did PEPFAR's expenditure per person reached for the prevention of mother-to-child transmission change over time? What were the respective proportions in this unit expenditure of health system strengthening and support for the provision of services? How did the efficiency of PEPFAR investments in the intervention change in Kenya over time? Increasing efficiency here may be demonstrated by similar or greater results achieved with lower levels of financial resources.

Finally, we explore the programmatic conclusions that can be drawn from this analysis for similar PEPFAR programs in the present.

We studied the period 2005–10, concentrating on overall trends. This period was chosen because PEPFAR investments in Kenya were low prior to 2005. Also, the time span includes both phases of PEPFAR and is sufficiently long for trends to emerge.

PEPFAR In Kenya, 2005–10

Through PEPFAR, more than $2.3 billion in US government funds was invested in Kenya between fiscal years 2004 and 2010.[4,5] During fiscal year 2004 PEPFAR support amounted to $27 million; in fiscal year 2005 this support increased to $125 million, marking 2005 as the start of a new era. By fiscal year 2010 the approved amount was about $548 million—more than a twentyfold increase over fiscal year 2004.[5]

During 2005–10 the US Agency for International Development (USAID) invested PEPFAR funding for the reduction of mother-to-child transmission of HIV through several mechanisms.[5,6] In fiscal year 2009, 65 percent of all USAID funds designated for this purpose were invested through the AIDS Population and Health Integrated Assistance II programs, which continued and expanded preceding HIV projects.[5]

We concentrated mainly on the AIDS Population and Health Integrated Assistance II project, and we selected two USAID implementing organizations that were active in the intervention from 2005 to 2010. These were the Elizabeth Glaser Pediatric AIDS Foundation and FHI360, formerly Family Health International.

The Glaser Foundation is an international nonprofit organization dedicated to preventing pediatric HIV infection and eliminating pediatric HIV/AIDS. It began work in Kenya in 2000, and,

under AIDS Population and Health Integrated Assistance II, it worked in the eastern and western provinces.[7,8]

FHI360, a global development organization that works in various development domains including health, has been active in HIV programs in Kenya since 1993. It participated in AIDS Population and Health Integrated Assistance II in the Coast and Rift Valley provinces.[9,10] Together these organizations covered half of Kenya's eight provinces for the intervention.

Study Data And Methods

DATA COLLECTION Overall funding data were obtained from USAID in Kenya. Financial and program records were collected from the Glaser Foundation and FHI360. Data for the chosen study period came from the foundation and FHI360 offices in Nairobi and Nakuru, Kenya.

Program records included quarterly, semiannual, and annual reports from the AIDS Population and Health Integrated Assistance II project (involving the Glaser Foundation for 2007–10 and FHI360 for 2006–10), as well as predecessor USAID projects, Call to Action (involving the Glaser Foundation for 2005–07) and IMPACT (involving FHI360 for 2005).[5]

Data on service delivery were received from each organization for three indicators selected from those regularly reported to PEPFAR: the number of pregnant women tested for HIV at prenatal (prelabor), labor, and postnatal stages; the number of HIV-positive pregnant women provided with antiretroviral drugs; and the number of live births to HIV-positive women.

The study team also interviewed eight key informants from the two organizations. Financial and program records from 2008 were not analyzed, because political violence in Kenya in that year undermined health care delivery and affected the validity of records.

Financial data collected consisted of program expenditures for each organization. In general, all expenditures explicitly marked as being related to the intervention were included. In addition, we included expenditures related to activities supporting sustainability goals.

Exhibit 1 tabulates the definitions of service delivery and the included domains of health system strengthening. For each it provides related examples of costs that we encountered in the records of the Glaser Foundation and FHI360. Costs in all of these categories for both organizations included labor charges of staff in Kenya as well as at headquarters in the United States; other direct costs; and all indirect costs, including overhead.

We estimated the cost of commodities for the intervention (drugs such as antiretrovirals, test kits, and so on), the related supply-chain cost, plus technical assistance supported by PEPFAR. Data on the cost of commodities for the intervention and their supply chain, as funded by PEPFAR through USAID's Kenya Pharma project, were available for fiscal year 2010 at the national level. These included the costs of technical support from the PEPFAR-funded Partnership for Supply Chain Management project, which provides technical assistance to strengthen developing countries' procurement, warehousing, and distribution systems for health commodities.

We collected data from the Kenyan Ministry of

EXHIBIT 1

Definitions Of Domains And Related Activities In Glaser Foundation And FHI360 Support For An Intervention To Prevent Mother-To-Child Transmission (PMTCT) Of HIV In Kenya

	Definition	Examples of activities that entail costs
SUPPORT TO SERVICE DELIVERY		
Service delivery	Investments to enable the provision of PMTCT services at the facility and community level	Train to deliver PMTCT services, print PMTCT registers, distribute test kits and reagents
SUPPORT TO HEALTH SYSTEM STRENGTHENING		
Country ownership	Investments to promote country government–led planning, evaluation, and program implementation	Support District Health Management Teams, assist national strategic planning, hold country-level workshops
Enhanced capacity building	Investments to build knowledge and competencies in areas adjacent to service delivery	Provide training for commodities management, ART/TB integration, quality improvement
Strengthening of support systems and infrastructure	Investments in equipment, infrastructure, and certain processes in the health system that benefit all HIV/AIDS services	Purchase CD4+ test equipment, renovate facility sites, establish data systems for monitoring and evaluation, assist in setting up laboratory network

SOURCE Authors' analysis. **NOTE** ART is antiretroviral therapy.

Medical Services on facility-level total outpatient loads for the specific facilities supported by the Glaser Foundation and FHI360. The intent was to identify all visits related to prevention of mother-to-child transmission as a proportion of all outpatient visits.

ANALYSIS We analyzed financial data over the study period and split costs into two categories: support to service delivery for the intervention, and support to health system strengthening. Health system strengthening expenditures were composed of support for country ownership, capacity building for sustainability, and better support systems and infrastructure. We assume that all organizations accessed the commodities from the PEPFAR-supported supply chain in similar ways and that the unit costs as a result were the same.

The approach taken here is program-level expenditure analysis, which takes as the unit of analysis the organization and not the facility it supports. Such an approach differs from a facility-level costing analysis, which would sample a set of facilities and would inventory and value all inputs into the facility for the intervention.

Once all data were collected, quantitative data were related to the reports and qualitative information for each implementing organization, providing context for expenses and services over time and highlighting major developments in spending.

The number of HIV-positive pregnant women provided with antiretroviral drugs was used as one denominator in the unit expenditure analysis. As another denominator for unit expenditure, we estimated the number of infant HIV infections averted at six weeks after birth, per quarter, through the intervention provided at sites supported by the foundation and FHI360. A description of the calculations for this denominator is provided in the online Appendix.[11]

Kenya began to implement new guidelines for the intervention in 2010, based on new World Health Organization guidance.[12] Prior to this, mixes of different antiretroviral drugs (where each mix constituted a "regimen") were used to prevent transmission to infants from HIV-positive mothers, based on previous guidance from 2006. Also prior to 2010, the provision of antiretroviral drugs after birth to HIV-exposed infants, as per the recommended protocol, was not always completed.

In calculating the estimated mother-to-child transmissions prevented by the intervention, we allowed for the differences in prevention effectiveness across the varying regimens used in Kenya with HIV-positive mothers and for the gaps in provision of antiretrovirals for infants after birth. Our methods produced estimates of the prevention effectiveness of the intervention in Kenya comparable to those in other studies. For 2010 we estimated an average mother-to-infant transmission rate at six weeks after birth of 7.5 percent in facilities supported by FHI360 or the Glaser Foundation—comparable to an estimate of 7.7 percent from a recent sample study involving 1,005 HIV-exposed infants in Kenya.[13]

Unit expenditures—defined as the average spending on goods and services incurred by PEPFAR per unit of the two denominators discussed above—were derived for each organization per quarter across the study period, except for 2008.

Across quarters, weighted average unit expenditure was generated for each year of the study period, where the weights were the quarterly values of the service indicator used as the denominator for the unit expense. This reduced the impact on average expenditure of start-up quarters and quarters at the end of the program, when service delivery was substantially lower than trend. This weighting scheme resulted in a small variation from a simple average.

LIMITATIONS We excluded costs of short-term technical assistance related to the intervention if the assistance was provided through global projects funded by USAID. Including the organizations providing such short-term assistance in this analysis was not feasible, given constraints of time and resources. The resulting underestimation of total investment in the intervention in Kenya via USAID is likely to be minor.

Our focus on PEPFAR investments through USAID limited our ability to generalize our findings to all PEPFAR funding, especially if the cost structures of services managed by other agencies are substantially different. Although our results are generalizable to other organizations funded by PEPFAR for the intervention in Kenya and other countries in East Africa, they may have limited applicability to other regions.

For one organization, financial data from 2005–07 were available only at the fiscal year level. Also, it was not always possible to disaggregate health system strengthening investments by intervention—that is, to identify those investments specifically related to the prevention of mother-to-child transmission.

The default assumption we made was that health system strengthening investments were broadly beneficial to the entire HIV/AIDS program and, in most cases, to the health system. This assumption had implications for unit expenditure calculation, which we discuss below.

The calculation of mother-to-infant transmissions averted relied on the details of the drug regimen used over time. The details on typical

regimens used over this period were obtained from one organization. However, we believe that these were similar for other organizations. Also, we measured the contribution of commodity-related costs—that is, the expenditure on purchase and distribution of antiretroviral drugs and other materials needed for the intervention—only for 2010, because of data availability. A more robust analysis could measure change in unit costs of PEPFAR support for commodity procurement and the supply chain over time. However, such an expanded commodity cost analysis would not change the conclusions we drew from the trends related to health system strengthening and service delivery expenditure.

Study Results

EXPANSION OF PEPFAR SUPPORT TO SERVICE DELIVERY PEPFAR has supported Kenya since the intervention was in its infancy. A small number of intervention pilot sites were established early in the 2000s for the intervention to assess feasibility and refine the processes for expansion.[14] Thereafter, the Glaser Foundation and FHI360 actively supported expansion of the program.

From the beginning of 2005 to the end of 2010, the number of facilities offering the intervention that were supported by the Glaser Foundation or FHI360 increased from 77 to 1,262—an average year-on-year rate of increase of 119 percent.[15] Starting in 2005 the program also began a period of rapid expansion of services delivered (Exhibit 2).

From 536 HIV-positive mothers reached with antiretroviral drugs in the first quarter of 2005, sites supported by the Glaser Foundation and FHI360 reached 4,272 such women in the last quarter of 2010—an eightfold increase. The number of pregnant women tested for HIV increased twelvefold over the same period.

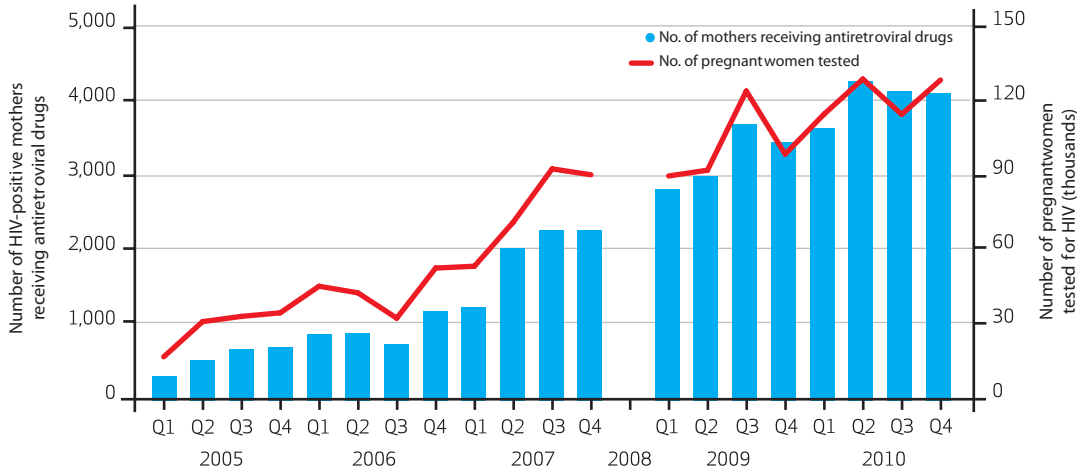
This expansion in the reach of the intervention required rapid growth in numbers of trained health workers. Over the course of 2005–07 and 2009–10, 17,700 health workers were trained by the foundation and FHI360 in the delivery of the intervention. By 2010, 4,000 of Kenya's 4,400 facilities offering maternal and child health services also offered the intervention.[16]

As the intervention was scaled up throughout Kenya, the complexity also increased. In its least effective form, the intervention involved the provision of a single dose of the antiretroviral drug nevirapine to HIV-positive mothers, to be taken at the onset of labor. It was required that after birth, infants exposed to HIV in the womb be given the same medication; however, this practice was not followed all the time. We estimate that in 2005 only 30–50 percent of HIV-exposed infants received antiretroviral drugs after birth.[7–10]

Based on the revised World Health Organization recommendations of 2006, intervention guidelines in Kenya also changed.[17] A larger proportion of HIV-positive pregnant women received a more effective intervention for preventing HIV transmission involving zidovudine at

EXHIBIT 2

Number Of Women Reached By The Intervention At Sites Supported By PEPFAR Through FHI360 And The Glaser Foundation, By Quarter, Selected Years 2005–10



SOURCES FHI360 and the Elizabeth Glaser Pediatric AIDS Foundation. **NOTES** Number of HIV-positive mothers receiving antiretroviral drugs is represented by blue bars and relates to the left-hand *y* axis. Number of pregnant women tested for HIV is represented by the red line and relates to the right-hand *y* axis. Data for 2008 are not shown because political unrest inhibited the collection of reliable information for that year. PEPFAR is President's Emergency Plan for AIDS Relief.

the start of the third trimester, followed by a combination of three antiretroviral drugs (including zidovudine) during labor, and a combination of zidovudine and another antiretroviral drug for a week after delivery.

As recommended, HIV-exposed infants were also increasingly provided with a regimen of two antiretroviral drugs after birth. Health workers were retrained in the new guidelines with PEPFAR support. By 2009 more than two-thirds of all HIV-positive pregnant women in Kenya received at least a combination of two antiretroviral drugs, and more than half were making the recommended four or more prenatal clinic visits.[16]

A certain proportion of HIV-positive mothers require full antiretroviral treatment for their own health because of the nature of the disease in their bodies. Establishing this need requires tests, such as the count of CD4+ lymphocytes (white blood cells involved in the immune system's defense against tumors and infections), which declines with advanced HIV infection.

In addition, the ability to test the HIV status of the exposed infants (so that they can be referred for pediatric antiretroviral treatment as soon as possible) requires collecting and processing dried blood spots. These tests necessitated the training of facility-level staff. Both the Glaser Foundation and FHI360 provided training and equipment at the facility level as the program evolved.

INVESTMENTS IN HEALTH SYSTEM STRENGTHENING Both the Glaser Foundation and FHI360 conducted activities related to health system strengthening that addressed the needs of the intervention. In the case of the Glaser Foundation, these activities were linked to its core areas of prevention of mother-to-child transmission and pediatric antiretroviral therapy. Some examples of activities and related costs are in Exhibit 1.

The first component of health system strengthening was country ownership. As services to prevent of mother-to-child transmission became more widespread, country ownership became critical. Activities in this context involved improving the ability of national and provincial-level government staff to plan and implement the delivery of HIV services.

In time, multisectoral engagement, especially with the community and civil society, also became important. This process included meetings of community members and health workers providing the intervention at health facilities, and the engagement of local women's groups and religious leaders to drive greater enrolment in the intervention, beginning from higher proportions of pregnant women attending prenatal clinics. The Glaser Foundation and FHI360 provided support to national technical working groups to support the development and dissemination of policies and guidelines related to the intervention. Both implementing organizations invested resources to strengthen the use of data for decision making at all levels of the health system.

The second component was enhanced capacity building. The need increased for health administrators at the district and provincial levels trained in the management of larger and more complex programs. Increasing complexity of supply-chain logistics; integration of HIV services and other health programs such as maternal and child health care and family planning; and focus on quality all contributed to this need.

The Glaser Foundation and FHI360 invested PEPFAR resources in such capacity building for sustainability, often in parallel with training to support the delivery of services at the facility level. The training curriculum was developed and then offered to health administrators, community leaders, and supervisors. It included training to recognize societal concepts of stigma associated with having HIV/AIDS and reduce such stigma, commodity management, quality improvement, and social engagement. Another major capacity-building initiative, undertaken by the Glaser Foundation, was to create and scale up a quality improvement program targeting the intervention.

A third component of health system strengthening consisted of improvements in support systems and infrastructure. This component included investments in facilities, laboratory equipment, and management and distribution systems for drugs and other commodities. These investments improved the functioning of the health system as a whole, with benefits also accruing to the services to prevent mother-to-child transmission.

As new facilities entered the program, the Glaser Foundation and FHI360 were often involved in facility renovations and improving facilities' workflow. In addition to renovations, the laboratory network was strengthened as equipment for tests of CD4+ cells (to track the progression of HIV disease) and early infant diagnosis was procured and facility-laboratory linkages were strengthened. In 2006 about 14 percent of the Glaser Foundation–supported sites had access to early infant diagnosis through dried blood spot testing. By 2010 this share had risen to 100 percent.[7,8]

OVERALL UNIT EXPENDITURES We present the average, across FHI360 and the Glaser Foundation, of unit expenditure for PEPFAR support per HIV-positive mother provided with antiretroviral drugs for the intervention, excluding com-

modity costs. Average unit expenditure can be understood as the average spending incurred in producing one unit of a good or service—in this case, the provision of antiretroviral drugs to an HIV-positive mother to prevent transmission of HIV to her infant.

Across the study period, this unit expenditure was the highest in 2005 at $567 (Exhibit 3). It declined 52 percent, to $271, by 2010. Values have not been adjusted for inflation. The decline in unit expenditure occurred even as the complexity of the intervention increased.

This decline is partially explained by economies of scale, because benefits of early investments were realized in facilities that were increasingly equipped, staffed, and delivering services. During 2005, 3,759 HIV-positive mothers were provided with antiretroviral drugs across both organizations. By 2007 more than 10,000 received the intervention through both organizations.

For 2010 we divided the total cost to PEPFAR of commodities for the intervention, logistics, and associated technical assistance for supply-chain management by the number of HIV-positive mothers provided with antiretroviral drugs through PEPFAR nationally (70,339). This calculation resulted in a value of $48 per person. This value can be applied to the unit expenditure as derived above.

Therefore, the estimated average unit expenditure to PEPFAR per HIV-positive woman provided with antiretroviral drugs for the intervention, including commodities and the supply chain, was approximately $319 in 2010.

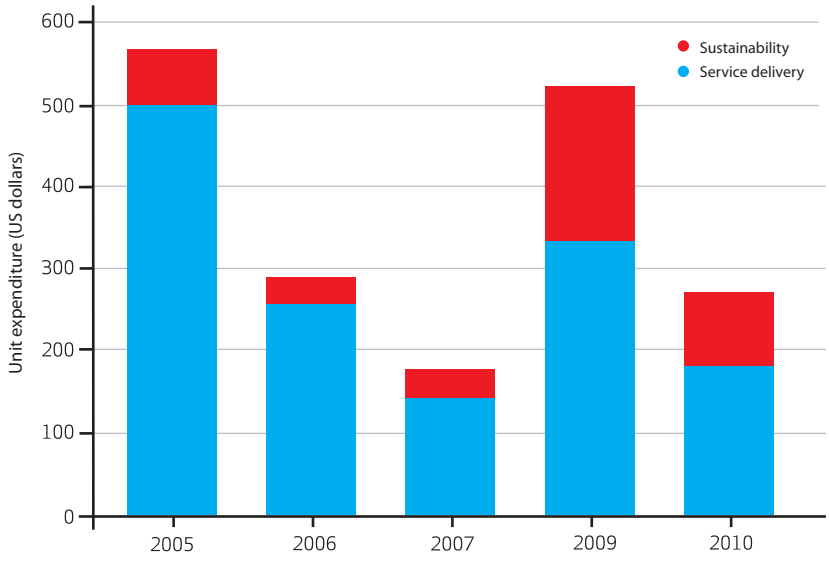
We estimated the number of mother-to-infant transmissions averted per quarter using the methods described in the Appendix.[11] Hence, the unit expenditure for PEPFAR can also be estimated in terms of impact, using the estimated number of mother-to-infant transmissions averted as the denominator.

In 2005 the intervention services supported by the foundation and FHI360 averted an estimated 282 mother-to-infant transmissions. In 2010 that number rose to 1,757—an increase of more than 520 percent. During this time period, the unit expenditure of PEPFAR support per mother-to-infant transmission averted through these organizations declined by 66 percent, from $7,117 in 2005 to $2,440 in 2010. This estimate excludes the cost of commodities and the supply chain.

The unit expenditure estimate here cannot be easily compared to facility-level costing studies, because the analysis here was conducted at the level of the program. However, as a reference figure, a facility-level costing study of an intervention in Tanzania for prevention of mother-to-infant HIV transmission using full antiretroviral therapy for HIV-positive mothers estimated a cost of $7,204 per mother-to-infant transmission averted (2007 dollars).[18]

EXHIBIT 3

Unit Expenditure For PEPFAR Support Through FHI360 And The Glaser Foundation Per HIV-Positive Mother Provided With Antiretroviral Drugs, Selected Years 2005–10



SOURCE Authors' calculations. **NOTES** Data for 2008 are not shown because political unrest inhibited the collection of reliable information for that year. PEPFAR is President's Emergency Plan for AIDS Relief.

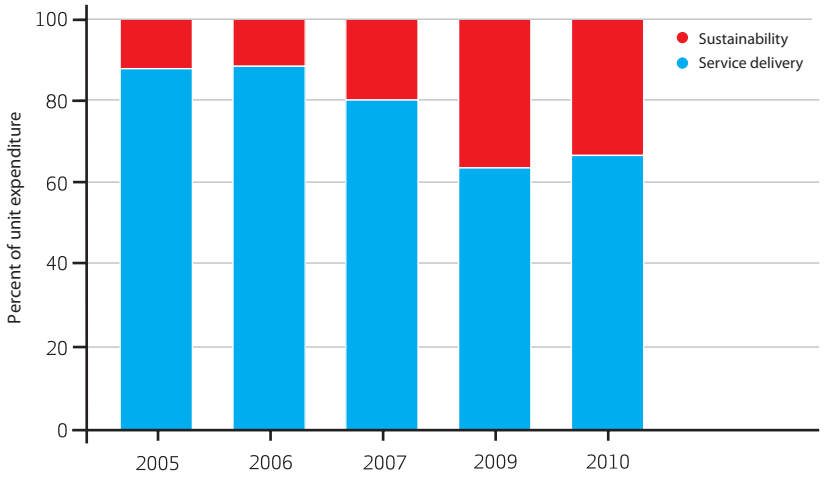
SPENDING FOR HEALTH SYSTEM STRENGTHENING Investments to strengthen a country's health system are believed to benefit the entire HIV program, at a minimum, and potentially the wider health system. In a few cases, the investments made by the Glaser Foundation were directly tied to the prevention of mother-to-child transmission. Therefore, the specific health system strengthening expenses could be entirely assigned to the unit expenditures above, without any need for adjustment.

However, in general, such investments were not directly tied to a particular intervention. Given this, an adjustment could be made to assign only a portion of the investments as accruing to the intervention, so as to not overestimate the unit expenditure.

A justifiable adjustment method was difficult to find. We consider some methods in the online Appendix.[11] Given this limitation, we applied the entire health system strengthening expenditure to our calculations of unit expenditure for the intervention. With this, health system strengthening grew as a proportion of expenditures throughout the study period, from 12 percent of unit expenditures in 2005 to 33 percent in 2010 (Exhibit 4). This intensification amounted

EXHIBIT 4

Composition Of Unit Expenditure For PEPFAR Support Through FHI360 And The Glaser Foundation Per HIV-Positive Mother Provided With Antiretroviral Drugs, Selected Years 2005–10



SOURCE Authors' calculations. **NOTES** Data for 2008 are not shown because political unrest inhibited the collection of reliable information for that year. PEPFAR is the President's Emergency Plan for AIDS Relief.

to a $22 increase in health system strengthening investments per HIV-positive mother provided with antiretroviral drugs from 2005 to 2010 ($68 versus $90). In terms of unit expense to PEPFAR per mother-to-infant transmission averted, health system strengthening spending rose from an average of $291 in 2005 to $490 in 2010 for the two organizations.

The calculation above may overestimate the total unit expense to PEPFAR per HIV-positive mother reached with the intervention or per mother-to-infant transmission averted.

Discussion

We conducted an original analysis of the financial implications of PEPFAR investments in health system strengthening and service delivery related to the HIV response in a resource-limited country. Such analyses, along with assessments of the benefits of such investments in the long term, will be necessary to inform PEPFAR decision making.

For the study period, we have shown a decline in unit expenditure related to the prevention of mother-to-child transmission for PEPFAR. We did not conduct an economic analysis that established costs across all actors, including the Kenyan government, which bears the expense of staff salaries and facility construction, among other costs.[16]

Specifically, for PEPFAR, our results suggest increasing levels of efficiency in its support for the prevention of mother-to-child transmission of HIV, given the scale of the program. This may derive from the fact that services increased more quickly than expenditures, notwithstanding year-to-year variations.

In terms of the denominator of mother-to-infant transmissions averted, efficiency has also derived from the improved effectiveness of the medical intervention. These examples of improving efficiency are an important contributor to future sustainability, because similar or greater results may be achieved with lower levels of financial resources. In the past decade, PEPFAR's investments in health system strengthening have accompanied major progress in scaling up service delivery to prevent the transmission of HIV from mother to child. In the area of country ownership, support for country-led decision making has enabled national and provincial leaders to understand their programs and provide guidance that promotes efficiency.

Enhanced capacity building has broadened the skills of health administrators in areas such as commodity management and quality improvement, leading to less waste and more resources for HIV prevention. Finally, by investing in support systems such as the laboratory network and intervention workflow, PEPFAR has supported expansion in services, allowing more women to receive a broader range of services at a single facility.

Whether continuing investment in health system strengthening is desirable in countries such as Kenya requires a multifaceted argument broader than this study. For the intervention in Kenya, these investments accompanied the expansion of service delivery. Kenya experienced a steady upward trend in both the number of mothers tested for HIV at prenatal clinics and the number of HIV-positive mothers receiving antiretroviral drugs during the study period. This is matched with a trend of increasing investment in health system strengthening and decreasing overall unit expenditure for PEPFAR.

Investing in health system strengthening did not inhibit the expansion of HIV/AIDS service provision. We did not observe strong evidence of a trade-off between scaling up services and investing in health systems. Others have argued that health system strengthening investments are a critical use of PEPFAR resources. Our results indicate that they are also increasingly efficient. ■

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NOTES

1 President's Emergency Plan for AIDS Relief. Five year strategy. Washington (DC): Office of the US Global AIDS Coordinator; 2009.

2 White House. Remarks by the president on World AIDS Day [Internet]. Washington (DC): White House; 2011 Dec 1 [cited 2012 Jun 18] Available from: http://www.whitehouse.gov/the-press-office/2011/12/01/remarks-president-world-aids-day

3 US Agency for International Development. USAID's global health strategic framework: better health for development. Washington (DC): USAID; 2012.

4 PEPFAR support to Kenya is channeled through several US government agencies. Key among them are the US Agency for International Development (USAID), Department of Health and Human Services (via the Centers for Disease Control and Prevention), Department of Defense, and Department of State. In fiscal year 2010 PEPFAR funding in Kenya could be split among these agencies, respectively, as follows: 64 percent, 30 percent, 4 percent, and 2 percent. In that year 54 percent of PEPFAR support to mother-to-child transmission prevention programs in Kenya was managed by USAID.

5 President's Emergency Plan for AIDS Relief. Country operating plan budgets for Kenya, 2004–2010. Washington (DC): PEPFAR; 2010.

6 During this period, major USAID projects with a role in the prevention of mother-to-child transmisison of HIV were Call to Action, IMPACT, APHIA II, and ACCESS. Drugs and other commodities were procured through the Kenya Pharma Project, with technical assistance in logistics through the Partnership for Supply Chain Management project.

7 AIDS Population and Health Integrated Assistance II Eastern Province. APHIA II Eastern Province—quarterly program reports. Nairobi: APHIA II Eastern Province Consortium Partners; 2007–11.

8 AIDS Population and Health Integrated Assistance II Western Province. APHIA II Western Province—quarterly program reports. Nairobi: APHIA II Western Province Consortium Partners; 2007–11.

9 AIDS Population and Health Integrated Assistance II Coast Province. APHIA II Coast Province—quarterly program reports. Nairobi: APHIA II Coast Province Consortium Partners; 2007–11.

10 AIDS Population and Health Integrated Assistance II Rift Valley Province. APHIA II Rift Valley Province—quarterly program reports. Nairobi: APHIA II Rift Valley Province Consortium Partners; 2007—11.

11 To access the Appendix, click on the Appendix link in the box to the right of the article online.

12 World Health Organization. Antiretroviral drugs for treating pregnant women and preventing HIV infection in infants: recommendations for a public health approach: 2010 version [Internet]. Geneva: WHO; 2010 [cited 2012 Jun 18]. Available from: http://whqlibdoc.who.int/publications/2010/9789241599818_eng.pdf

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14 IMPACT Project. Kenya final report September 1999–September 2007 for USAID's Implementing AIDS Prevention and Care (IMPACT) Project. Arlington (VA): FHI360; 2007.

15 Calculated as an average of year-on-year rates of growth in total number of facilities supported over 2005–10. See the online Appendix (Note 11) for a chart describing the growth in facilities supported by FHI360 and the foundation.

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ABOUT THE AUTHORS: ARIN DUTTA, NATHAN WALLACE, PETER SAVOSNICK, JOHN ADUNGOSI, URBANUS KIOKO, SCOTT STEWART, MAI HIJAZI & BEDAN GICHANGA

In this month's *Health Affairs*, Arin Dutta and coauthors explore the question of trade-offs that may exist between investments to promote health system strengthening, such as investments in facilities and training, and the rapid expansion of HIV/AIDS services. Examining data from two organizations carrying out contracts under the President's Emergency Plan for AIDS Relief in Kenya, they found that unit expenditure for PEPFAR support for the prevention of mother-to-child transmission declined over time, even as the share of expenditure devoted to strengthening health systems rose. As a result, they conclude, there was not strong evidence of a trade-off between scaling up services and investing in health systems. Dutta is a senior economist at Futures Group International. He works on topics involving HIV/AIDS and other infectious diseases

as well as health systems and health financing. He has extensive experience in capacity building and applied research related to economic evaluation, health finance, and health policy analysis.

In his recent work on developing HIV/AIDS programs, Dutta studied the efficiency and effectiveness of treatment and prevention interventions, modeling of local combination HIV prevention approaches, and the country-level strategies targeting most-at-risk populations. Dutta earned a doctorate and a master's degree in policy analysis from the Pardee RAND Graduate School.

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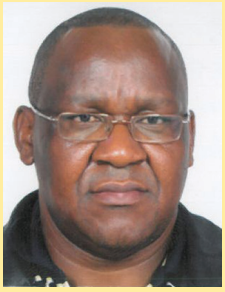
Peter Savosnick is a senior director for Africa at the Elizabeth Glaser Pediatric AIDS Foundation operation in Kenya, leading the efforts to develop and implement the organization's strategic pediatric AIDS plan. He has technical expertise in reproductive health, HIV/AIDS, and community-based health care. Savosnick has also worked extensively in project management, capacity building, organizational development, service delivery integration, health-sector decentralization and reform, information and management systems development, and monitoring and evaluation. He received his bachelor's degree in economics and business administration from the University of Stockholm, in Sweden.

John Adungosi is the director of care and treatment for FHI360 (formerly Family Health International) in Kenya. FHI360 is a nonprofit human development organization dedicated to improving lives by advancing integrated, locally driven solutions. Adungosi is also FHI360's director of technical support for the US Agency for International Development (USAID)–funded AIDS Population and Health Integrated Assistance–Plus project, which is a two-year health services delivery project. In these roles, Adungosi oversees the implementation of integrated HIV/AIDS, reproductive health, tuberculosis, maternal and child health, and malaria services. Adungosi earned a medical degree from Makerere University in Kampala, Uganda, and a master's degree in control of infectious diseases from the London School of Hygiene and Tropical Medicine, in the United Kingdom.



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Bedan Gichanga is the health systems specialist in the Office of Population and Health at USAID in Kenya. He is the activity manager for several USAID projects in Kenya, and he provides high-level guidance to the technical work of other global projects with a presence in Kenya. Gichanga holds a medical degree from the University of Nairobi and has an MBA from Keele University in the United Kingdom.