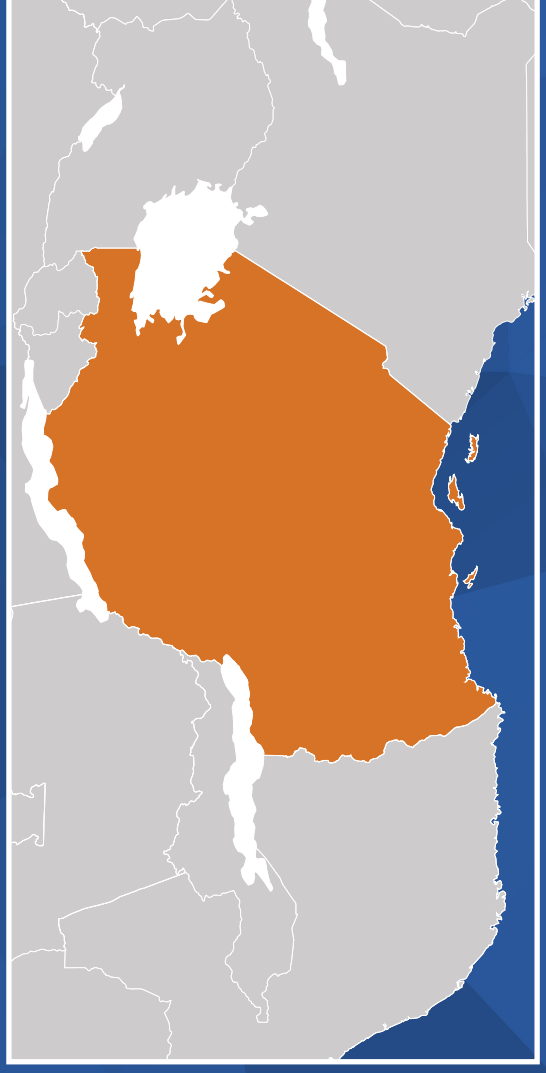

January 2022

APPLYING ACTIVITY-BASED COSTING AND MANAGEMENT TO HIV SERVICES IN TANZANIA

Improving Resource Allocation and Efficiency

USAID
FROM THE AMERICAN PEOPLE

HP+
HEALTH POLICY PLUS

JANUARY 2022

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Foreword

Activity-Based Costing and Management (ABC/M) is a multi-agency initiative led by the U.S. Global AIDS Coordinator with the U.S. Agency for International Development (USAID) as the technical implementation lead and additional high-level support provided by a technical review board consisting of the Office of the U.S. Global AIDS Coordinator (chair); USAID; the U.S. Centers for Disease Control and Prevention (CDC); the Joint United Nations Programme on HIV/AIDS (UNAIDS); the U.S. Treasury Department; the Global Fund; and the Bill & Melinda Gates Foundation. The ABC/M approach identifies costs for providing HIV prevention, testing, and treatment services. This will inform decision making for more financially sustainable and effective HIV programs through routine collection of service delivery costs.

Tanzania was the first country to adopt and implement the ABC/M approach, which has subsequently been applied in other countries such as Uganda, Kenya, and Mozambique using a consistent methods framework. In all cases, ABC/M is a country-owned effort with an in-country steering committee performing a governance role for the activity and a local research institution leading study efforts. ABC/M in Tanzania has been rolled out as a two-phased approach with Phase 1 concluding upon the publication of this report, which provides a retrospective baseline of HIV costs for one year at four different levels: above-site, facility, community, and patient costs. Initial plans for Phase 2 are to focus on capacity building and data use with the ultimate long-term goal of institutionalizing the ABC/M approach to provide cost data more routinely and reaching global consensus on the methods framework.

Abbreviations

ABC/M	activity-based costing and management
ART	antiretroviral therapy
ARV	antiretroviral
CD4	cluster of differentiation 4
CDC	U.S. Centers for Disease Control and Prevention
DHIS2	District Health Information Software 2
FFARS	facility financial accounting and reporting system
GoTHOMIS	Government of Tanzania Health Operations Management Information System
HP+	Health Policy Plus
HTC	HIV testing and counseling
IT	information technology
LGA	local Government Authority
LGRCIS	Local Government Revenue Collection Information System
MOFP	Ministry of Finance and Planning
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MSD	Medical Stores Department
MUHAS	Muhimbili University of Health and Allied Sciences
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PlanRep	Planning and Reporting System
PMTCT	prevention of mother-to-child transmission
PO-RALG	President's Office – Regional Administration and Local Government
PrEP	pre-exposure prophylaxis
TACAIDS	Tanzania Commission for AIDS
TDABC	time-driven activity-based costing
TZS	Tanzanian shillings
UNAIDS	Joint United Nations Programme on HIV/AIDS
US$	U.S. dollar
USAID	U.S. Agency for International Development
VMMC	voluntary medical male circumcision

Executive Summary

Investments from donors and countries in costing studies over the years have been important for estimating resource needs for the HIV response. The U.S. Global AIDS Coordinator, with the U.S. Agency for International Development as the technical lead and in collaboration with the Health Policy Plus project, has implemented an activity-based costing and management (ABC/M) application that provides cost data to improve the cost-effectiveness and efficiency of high-quality HIV-related service delivery in Tanzania.

Phase 1 of the ABC/M application concludes with the publication of this report, which provides a retrospective baseline of HIV costs for one year at four different cost levels: facility, community, client, and above-site. Costing was done for five HIV interventions: antiretroviral therapy for new, stable, and unstable patients; HIV testing and counseling; prevention of mother-to-child transmission; voluntary medical male circumcision; and pre-exposure prophylaxis. Phase 1 included a landscape assessment that determined where patients seek HIV services and a data systems assessment to identify gaps that need to be addressed in order to produce more routine HIV cost data. Phase 2 (started in June 2021) initially focuses on capacity building and data use with the ultimate long-term goal of institutionalizing the ABC/M approach to provide cost data more routinely.

In Phase 1, facility-level costs were determined using a method called "time-driven activity-based costing" (TDABC), an approach that measures costs at the patient level by directly observing resources allocated throughout the patient's care visit. An advantage of the TDABC approach compared to more traditional costing methods is the development of process maps, which can provide insight into how services are delivered and allow for easy comparisons between clients and facilities. It was not possible to apply the TDABC approach at the above-site and community levels given data, time, and resource constraints; therefore, a top-down approach was used. Client-level costs were determined from income, assets, and consumption information gathered from a client exit survey.

At the facility-level, findings showed that while antiretrovirals and lab tests are the largest cost drivers, personnel capacity cost rates are very low, even for the highest health cadres, such as medical doctors. There were substantial variations observed in the way services were delivered across facilities and, even within the same facility, the care process could vary among clients with process steps sometimes skipped. Clinical contact times were shorter than expected compared to the protocols, while waiting times were longer than optimal. At the community level, care and treatment support services were estimated to be US$11.24 per client while above-site expenditures represented a significant proportion of all costs. Finally, at the client level, opportunity costs and direct transport costs were significant, but out-of-pocket spending for HIV services at the facility was near zero.

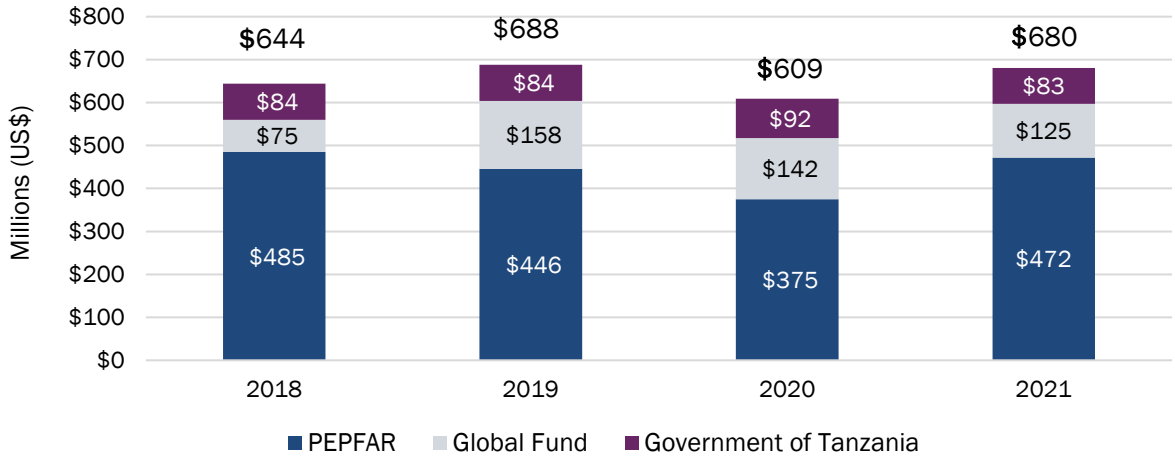
It will be important to get clinical leadership's interpretation of the data to understand the root causes of what was observed. Given the significance of above-site costs, understanding drivers may show potential for efficiency gains. More insight into the extent of absenteeism will enable more accurate estimates for personnel costs and it's possible that low wages for clinical staff may contribute to absenteeism. Lastly, direct transport and opportunity costs borne by the client are significant, highlighting the importance of differentiated care that removes barriers to access of HIV services.

Introduction

Tanzania HIV Landscape

In Tanzania, HIV remains a high-burden disease, with 1.7 million people living with HIV and an adult prevalence rate of 4.8 percent (UNAIDS, 2020). With significant financial support from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund (see Figure 1), Tanzania has achieved high antiretroviral therapy (ART) coverage of 75 percent (UNAIDS, 2020). In 2021, PEPFAR funded 70 percent of the total budget of US$680 million for the HIV response, while the Global Fund contributed 18 percent, primarily for the procurement and distribution of antiretroviral (ARV) drugs and laboratory commodities. The government of Tanzania contributed 12 percent, most of which was for healthcare worker salaries and facility operational expenses. However, additional resources will be required to achieve "test and start" treatment policies and to attain the 95-95-95 targets suggested by the Joint United Nations Programme on HIV/AIDS (UNAIDS). Given the current trend of flat or declining external support for HIV, there is an urgent need to increase domestic resources to achieve program objectives. In this context, effective and efficient allocation of resources will be key factors affecting HIV program sustainability in Tanzania.

Figure 1. Trend in Total Budget for HIV by Funder, 2018–2021



Source: PEPFAR, unpublished (2020, 2021)

Study Rationale

Investments from donors and countries in costing studies over the years have been important for estimating resource needs for the HIV response, identifying significant cost drivers, and increasing efficiency of service delivery. However, these figures may be incomplete and/or quickly become outdated as the epidemic evolves, and reliability of these estimates over time is compromised by transformations in service delivery modalities, variable availability of HIV-related services at subnational levels, changing demographic characteristics of persons newly infected with HIV, and new technologies and price changes.

Policymakers and partners involved in funding, establishing, and managing HIV-related programs have a need for current and regularly updated information on how costs, financing, utilization, and performance of different patterns of delivery vary, and the factors that affect them. This highlights the need for cost analyses that reflect the swift pace of

changes to HIV care cascades in recent years and to establish an approach that regularly collects data to produce valid and reliable information required for decision making.[1] Additionally, the reduction of international assistance for health and competing demands for public funding have increased the emphasis on transparency of expenditures and placed a focus on health spending efficiency and performance measurement in HIV-related services. This has become even more evident during the COVID-19 pandemic with countries facing unforeseen fiscal constraints compounded with an increased need for emergency funding to address the health and economic impacts of the pandemic.

To meet these demands, the U.S. Global AIDS Coordinator, with the U.S. Agency for International Development (USAID) as the technical implementation lead and funding from the Sustainable Financing Initiative for HIV/AIDS (SFI)—and in collaboration with the USAID-funded Health Policy Plus (HP+) project, Muhimbili University of Health and Allied Sciences (MUHAS), and the National Institute for Medical Research—has implemented an activity-based costing and management (ABC/M) application that will provide routine data to improve the efficiency, cost-effectiveness, and quality of HIV-related service delivery in Tanzania. The ABC/M approach identifies actual costs for providing HIV prevention, testing, and treatment services—with the express aim of equipping policymakers with a robust rationale for optimizing resource allocation for the HIV response and promoting transparency of expenditures. This approach has global consensus with key donors and stakeholders.

In addition to measuring service delivery costs, this approach requires an understanding of what HIV activities are funded at a non-service delivery level, above-site level, and community levels. Examples of non-service delivery activities include clinical mentoring, supportive supervision, and training; examples of above-site expenditures include resources spent on activities related to policy, governance, health systems administration, coordination, and training. Many countries, including Tanzania, have adopted differentiated service delivery models to enhance efficiency and patient-centeredness in the delivery of services across the HIV clinical cascade. A systematic framework is needed for routinely mapping resources and care delivery processes across cadres and health systems to promote viral suppression among HIV patients.

Value of Time-Driven Activity-Based Costing at the Facility Level

At the facility level, HP+ collected data using time-driven activity-based costing (TDABC), an approach that allows costs to be accurately measured at the patient level throughout the care cycle of a patient's medical condition. There are five main advantages to using the TDABC approach as opposed to more traditional costing methods (McBain et al., 2016):

1. Data are collected at the patient level, which assures direct observation of resources allocated to each patient and allows measurement of additional costs incurred when treating certain high-risk patients.
2. TDABC ascertains the cost of care for specific treatment pathways and therefore facilitates comparisons among specific interventions for treating the same condition.
3. TDABC measures the extent to which resource capacities are allocated to specific activities relative to others using a standardized metric, the capacity cost rate, which is explained in Table 1.

[1] The HIV care cascade refers to the steps that people living with HIV go through from initial diagnosis to achieving viral suppression.

4. Tracking patients through a care cycle maps the existing system of care (process maps) and helps identify opportunities to optimize the care cycle for better outcomes and efficiencies.
5. TDABC produces a cost estimate for each patient—based on the extent to which the patient consumes resources. This allows the data collection team to examine variation in resources and costs across patients including, for example, whether resources and costs differ according to patient demographics or the severity of the patient's condition.

Low-resource settings typically use a bottom-up approach such as the World Health Organization's Choosing Interventions that are Cost Effective (CHOICE) framework or a top-down approach to measure costs and produce estimates for setting priorities at a macro level (McBain et al., 2016). However, these approaches do not capture variations in the cost of care across patients, types of healthcare facilities, and providers. This knowledge gap has significant ramifications in low- and middle-income countries where resources are scarce and there is increasing pressure to improve efficiency, reduce the cost of care, and nevertheless generate positive patient outcomes. The benefits of applying TDABC in low-resource settings were made apparent in studies from Haiti (McBain et al., 2016) and Zimbabwe (Bodnar and Desai, 2019). The results in Haiti gave Partners in Health a firm basis for negotiating the price of health services with insurers and private funders plus the ability to identify opportunities for task-shifting to increase patient access to care, eliminate medicine stockouts, fix broken laboratory equipment, and standardize clinical protocols and processes to reduce patient-level variance in resource allocation (McBain et al., 2016).

An important note about the TDABC approach in low-resource settings is that, often, process varies considerably for care visits. For example, clinical contact times may be shorter in practice than what is recommended in the protocols. In these cases, the unit costs derived from a time-driven approach will be lower than in a normative costing approach.

Activity Scope

The overall ABC/M scope is being rolled out as a two-phased approach with Phase 1 (2020–2021) concluding with the publication of this report, which provides a retrospective baseline of HIV costs for one year at four different cost levels. Phase 2 (started June 2021) focuses on capacity building and data use with the ultimate long-term goal of institutionalizing the ABC/M approach to capture cost data more routinely and reach global consensus on the methods framework.

Under Phase 1, costs related to HIV programming were collected at four levels:[2]

1. At the facility level for direct provision of HIV services using the TDABC method; inputs for facility-level costs include personnel, facility space, equipment and furniture, consumables, and indirect costs

[2] It was not possible to apply the TDABC approach at the community level given time and resource constraints. However, there are plans to apply a TDABC "light" approach at the community level for subsequent applications of ABC/M as this would allow for better comparisons between costs at the facility and community levels. Meanwhile, the PEPFAR resource alignment tool is the only source of data for above-site expenditure for HIV. Given the breadth of and nature of the above-site programs (e.g., program management and non-service delivery) it did not make sense to apply TDABC at this level.

2. At the community level for HIV support programs for care and treatment and for testing, using a top-down costing approach
3. At the client level, through a client exit survey that was administered to determine costs borne by the patient for each facility visit and the client's perspective on the quality of service delivery
4. At an above-site level, which looked at expenditures supporting health administration, policy, governance, and training using a top-down costing approach

In addition to determining unit costs of HIV interventions, the scope of the study under Phase 1 included a landscape assessment with two parts: (1) an ecosystem mapping to determine where patients seek HIV services to better guide the facility sampling approach and (2) a data systems assessment to identify gaps that need to be addressed to produce more routine HIV cost data.

Subsequent work under ABC/M Phase 2 will focus on strengthening local capacity to apply the method and implement ABC/M, identifying the best use of the data accrued from the ABC/M application, and advocating for financial system upgrades to include higher-resolution information on vertical HIV programs. The primary goal of ABC/M Phase 2 will be to assure that the ABC/M application and associated processes for ongoing data collection are sustained and move toward institutionalization.

The remainder of this report will highlight the findings from Phase 1.

HIV Interventions

The focus of ABC/M in Tanzania was on people living with HIV who receive care and treatment in district hospitals and primary healthcare facilities. This included three different categorizations: new patients, stable patients, and unstable patients. Using the TDABC approach, HP+ was able to verify that the care pathway of a visit by an ART patient varied depending on patient classification. Assumptions were then made on the expected number of facility visits per year for each ART patient classification (based on the observed number of months of ARVs prescribed during facility visits) in order to annualize the cost per ART patient per year. In Tanzania, the eligibility criteria to be categorized as a stable patient is the following: (1) above 5 years of age, (2) has continuously received ART for at least six months, (3) has observed no adverse drug reactions that require regular monitoring, (4) has no current illness (opportunistic infections or co-morbidities), (5) has observed ART adherence at 95 percent and kept clinic visit appointments for the past six months, and (6) is receiving first-line ARVs, with undetectable viral load below 50 copies/mL (in the absence of viral load monitoring, rising CD4 counts > 350 cells/mm^3) (MOHCDGEC, 2017). ABC/M was also applied to the core prevention services of prevention of mother-to-child transmission (PMTCT), voluntary medical male circumcision (VMMC), oral pre-exposure prophylaxis (PrEP), and HIV testing and counseling (HTC) at the facility level. Pediatric clients under the age of 18 years were excluded from the study for all HIV interventions and all ART classifications.

Activity Governance

Steering Committee

A wide group of experts are supporting the implementation of the ABC/M across several countries in Africa. The initiative is led by the U.S. Global AIDS Coordinator with USAID

serving as the technical lead. Other members of the ABC/M review board include the U.S. Centers for Disease Control and Prevention (CDC), UNAIDS, the U.S. Treasury Department, the Global Fund, and the Bill & Melinda Gates Foundation. In Tanzania, the U.S. Global AIDS Coordinator and USAID facilitated introductory meetings with in-country stakeholders to explain the activity objectives and to ensure country buy-in from the government, partners, and the PEPFAR Tanzania team. An in-country steering committee was formed with designated points of contact for each institution involved in the support of the activity. The steering committee members consisted of representatives from: the PEPFAR Coordination Office, CDC, the U.S. Department of Defense, USAID, the Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC), the President's Office – Regional Administration and Local Government (PO-RALG), Tanzania Commission for AIDS (TACAIDS), UNAIDS, implementing partners (e.g., the Public Sector Systems Strengthening activity), the National Bureau of Statistics, and the Ministry of Finance and Planning (MOFP). A workshop to review the ABC/M approach with steering committee members signified the official launch of the ABC/M activities in February 2020. After the launch meeting, steering committee members were given the opportunity to provide inputs into the research protocol. Throughout the study, the steering committee was given periodic updates on the study progress. After dissemination and validation of the final results, the steering committee was given an opportunity to provide input into this report. The steering committee will also be involved with the implementation of Phase 2.

Research Institution

HP+ partnered with a local research institution, MUHAS, to implement the ABC/M application, including developing the research protocol and data collection instruments, securing ethical clearance, collecting the data, and participating in steering committee consultations. HP+ trained colleagues at MUHAS to manage the field work across selected facilities and to conduct quantitative and qualitative data collection using the ABC/M method. Additionally, HP+ supported the MUHAS team on data analysis and report development. As a result, MUHAS is now equipped to lead subsequent ABC/M applications given the significant investments made to build its capacity on the ABC/M approach.

Objectives and Research Questions

Cost Estimates of HIV Interventions to Inform Decision Making

The main short-term objective of implementing the ABC/M application was to identify costs for the provision of HIV services at facilities throughout Tanzania and to assess costs incurred by clients during the care cycle. The analysis was supplemented with the collection of HIV expenditure data at the community level and above-site level. While there have been other notable HIV costing studies completed in Tanzania (see CDC, unpublished), figures can quickly become outdated or do not account for how HIV service delivery has evolved. Another distinguishing feature of the ABC/M approach is that it provides a fully loaded unit cost that includes above-site and community-level costs, which previous costing studies in Tanzania have not.

The primary research question for the study was:

- What is the actual unit cost per recipient of providing select HIV services in Tanzania and what are the main drivers of the unit cost?

Secondary research questions, some of which will be further explored during ABC/M Phase 2, included:

- Can variations in cost be explained by facility and/or patient characteristics?
- Are there opportunities to drive efficiencies through improved, standardized processes?
- How can the collection of cost data be made more routine in order to produce a steady stream of needed and accurate cost data?

Applications of Activity-Based Costing and Management

ABC/M will help stakeholders identify actual costs for HIV services, which in Tanzania is largely unknown or has been determined for only one point in time. ABC/M is therefore more useful in an environment in which costs are constantly changing. This information is essential to facilitate strategic evolution toward increasing domestic resources and absorption of interventions into the government's programs and budgets. Some of the objectives for ABC/M remain aspirational and the scope of Phase 2 includes identifying the best use of ABC/M data and findings for HIV-related financial planning and management. High-level applications of ABC/M data include:

- Facilitating a more financially sustainable and effective response for HIV service delivery via routine use of data on service delivery cost and resource allocation
- Filling information gaps on service delivery to accelerate the reach of HIV prevention, testing, and treatment to those who have been left behind, which is necessary to curb the epidemic
- Supporting the goal of moving Tanzania toward higher levels of country ownership and sustainability of its HIV program
- Informing the development of broader national strategic plans
- Laying groundwork for more effective and efficient value-based provider payment rate-setting in the future, for example from health insurance schemes such as the National Health Insurance Fund

Methods

Landscape Assessment

Ecosystem Mapping

HP+ conducted a mapping exercise of the health facility ecosystem to show where clients were seeking HIV services and the patient volumes for those services. Secondary data were sourced from the government health facility registry, District Health Information Software 2 (DHIS2), and Service Availability and Readiness Assessment reports. This information was organized and disaggregated by HIV intervention type, level of the healthcare facility (tertiary hospital, secondary hospital, and primary/community healthcare centre), sector (public versus private/nongovernmental organization), geography (region and urban versus rural), and funder (PEPFAR versus government of Tanzania). HIV prevalence data by region was also sourced.

Data Systems Assessment

HP+ assessed which data systems in Tanzania were used to track clinical and financial information related to health service provision. The assessment included a literature review of existing reports and surveys and key informant interviews with implementing partners, such as USAID's Public Sector Systems Strengthening activity, which included organized demonstrations of the data systems. An interview guide was used to collect information on how routine data are collected, what data is being collected, and how the data are used. This assessment informed discussions on the data systems architecture needed to produce more routine, up-to-date costing information that can be used for budgeting, monitoring, and analysis.

Facility-Based Costs

TDABC was used to capture costs for care and treatment provided to persons living with HIV, core prevention services (e.g., PrEP), and HTC at the facility level. Overall, TDABC identifies and measures the following:

- **Activities**: Those that are performed over the care visit for a condition, who performs each activity, and how long they spend on each activity.
- **People, furniture, equipment, and facility space**: Cost per unit of time for each type of personnel, furniture, equipment, and facility space used during the care visit (capacity cost rate).
- **Materials**: Those that are consumed during the care visit (supplies/consumables, drugs, lab tests and reagents, test kits, etc.).
- **On-site indirect cost**: Additional costs incurred that are not directly consumed over the care visit. These are costs that do not directly contribute to individual patient care but are expended for service provision to be made possible, such as salaries of administrators, cleaners, security personnel, and utilities such as heating and electricity.

Time-Driven Activity-Based Costing

The TDABC method applied at the facility level, developed by Robert Kaplan and Michael Porter at Harvard Business School (Kaplan and Porter, 2011), is a seven-step approach:

1. **Select the medical condition and/or patient population:** As noted in the activity scope, the HIV interventions included in the study are ART, HTC, PMTCT, PrEP, and VMMC. ART costs were further subdivided into new, stable, and unstable patient categories.
2. **Define the care delivery value chain:** The care delivery value chain is both a descriptive and prescriptive tool that charts the full set of activities involved in a patient's complete care visit, spanning multiple providers and nonclinical settings. Key informant interviews were conducted with the "facility-in-charge" at each facility to provide a simple map of the care delivery value chain for when and where HIV services are provided and what activities are performed at each stage and by whom. When required, multiple people were interviewed.
3. **Develop process maps of care delivery for each medical condition:** Process maps depict the path that a patient would be expected to follow when receiving care during a facility visit. The process map includes the capacity-supplying resources

(personnel, facilities, equipment, furniture, and consumables) involved in each step of the care visit used by the client or provider. A separate process map was developed for every HIV intervention in the study and key informant interview responses were used to develop them. Process maps created during the study are available upon request from policyinfo@thepalladiumgroup.com.

4. **Obtain time estimates for each process step:** Data collectors measured the time that providers spent delivering care, inclusive of time with a patient and non-patient time. The patient time was quantified by shadowing patients; the non-patient time was quantified based on self-reports of time spent gathered in informant interviews. How much time a piece of equipment or other resource was used for each process step was also quantified from key informant interviews. Estimates of time and steps required gathered during the interviews were compared with data collected while following patients—done to assess inconsistencies between the normative process map and the actual steps taken during delivery of care.
5. **Estimate the cost of supplying patient care resources:** The research team estimated costs of all inputs used to provide the necessary patient care, including direct and indirect costs. Direct costs included staff compensation, depreciation or leasing of equipment and furniture, and supplies. These data were collected from general facility ledgers, budgeting systems, other information technology (IT) systems, and price lists from the Medical Stores Department and the Global Fund Pooled Procurement Drug List. Indirect costs included support staff and other overhead expenses needed to provide services but not directly related to HIV services, such as utilities, infrastructure, etc. See Table 1 for the data needed for each resource type.

Table 1. Data Needed to Calculate the Capacity Cost Rate per Resource Type

Resource	Data Needed
Personnel	• Total number of days an employee works per year • Total number of hours worked per day • Average number of hours used for non-patient work (e.g., breaks, training, education, and administrative meetings)
Equipment and Furniture	• Current cost of replacing an item • Useful life of equipment • Quantity of items in a room • Total available equipment minutes
Facility Space	• Square meters of building and facility space • Cost of construction or rent per square meter • Useful life of space • Total availability of space in a given year
Indirect	• Annual overhead expenditure (electricity, maintenance, etc.) over 12 months • Total outpatient and inpatient visits per year • Average duration of inpatient visit

Source: Adapted from Kaplan and Anderson (2004) and McBain et al. (2016)

6. **Estimate the capacity of each resource:** This consists of estimating the capacity cost rate for personnel, equipment, furniture, facility space, and indirect costs. Data on the annual cost of each resource were obtained and divided by how often, in

minutes, the resource could be used annually (the practical capacity). This is the hypothetical cost if resources were used at their capacity. The resource capacity cost rate is estimated by dividing the resource's total cost by the resource capacity to obtain a rate measured in US$ per minute. Facility indirect capacity cost rates were calculated assuming that the duration of an average outpatient visit was the same as an average ART outpatient visit. For a catalogue of all major assumptions used in the study, see Annex A.

7. **Calculate the total cost of patient care per intervention:** This final step consists of estimating the unit cost of each HIV intervention. This is done by multiplying the capacity cost rates for each resource used in each patient process by the duration of a client's consumption of that resource (step 4). Then, the costs are summed across all processes used during the patient's care visit to arrive at an estimated total cost of the patient visit (see Annex B for an example of how unit cost stacks were calculated).

Community-Level Expenditure

The HIV response also includes programs offered in the community, including programs that target populations who have a higher risk of HIV exposure. Given the nature of these programs and time and resource constraints, it was not possible to apply the TDABC approach at the community level. To estimate community-level costs, HP+ interviewed seven HIV implementing partners that operate community-level HIV programs in the same catchment areas as the facilities in the sample. Each implementing partner provided information about the total expenditures their community programs incurred over the most recent 12 months and the number of HIV clients reached, per intervention.

Recognizing that a significant portion of implementing partners' expenditures were for non-service delivery and program management—which are expenditures also reported at the above-site level—HP+ used PEPFAR expenditure reporting data that disaggregated community-level expenditures for each implementing partner by non-service delivery, service delivery, and program management. To avoid double-counting, it was necessary to isolate the proportion of implementing partner expenditures that were not attributed to non-service delivery and program management.

Non-service delivery activities include clinical mentoring, supportive supervision, and training. To remove them from the unit cost analysis, HP+ assessed the service delivery/total expenditure ratio for care and treatment from each organization using expenditure reporting data and applied this to the community-level expenditures. This made it possible to isolate the estimated unit cost for service delivery, assuming the service delivery/total expenditure ratio at the community level was similar to the ratio for the implementing partner overall. HP+ also assumed that the national expenditure reporting data for each implementing partner would be comparable to the expenditure data collected for analysis, even though the expenditure data collected as part of the ABC/M exercise was focused on only selected regions in the country.

Next, HP+ removed program management from the unit cost analysis. This was done by calculating the percentage of program management expenditures relative to total expenditures (23 percent in Tanzania). The unit cost was reduced by this percentage to arrive at the unit cost for care and treatment that excluded both non-service delivery and program management. One assumption in this calculation was that program management as a proportion of all expenditures for implementing partners would be similar across all

interventions. This assumption was necessary because program management expenditures are not collected for a particular HIV intervention, but instead are collected for all interventions.

After removing estimates for non-service delivery and program management from the total expenditure of the implementing partner, HP+ calculated unit cost per HIV community intervention. This unit cost was calculated by dividing the implementing partner's expenditure by the number of HIV clients reached at the community level over a 12-month period.

It is important to highlight limitations of this method for calculating community-level costs. First, it is not possible to make direct comparison of the community-level unit costs with the facility-level unit costs because different methods were used. Second, PEPFAR expenditure reporting data only accounts for spending by PEPFAR and does not include spending by government or the Global Fund for community-level HIV interventions. Third, PEPFAR financial classification of community-level spending can be blurry—sometimes service delivery spending is classified as non-service delivery and vice versa.

Client Survey

HP+ administered a short 25-minute client exit interview prior to patients leaving the health facility, capturing the following information:

- Demographic data
- Socioeconomic data
- Health insurance coverage
- Costs borne by clients
- Patient satisfaction with current visit
- Service delivery performance

Cost to clients for each facility visit included out-of-pocket health expenses at the facility, transportation costs to get to and from the facility, and opportunity costs of seeking services. Opportunity costs were based on time spent at the facility and travel, calculated based on responses to questions on personal income. To map respondents to socioeconomic quintiles, HP+ created a simplified asset register that aligned strongly with Tanzania's Demographic and Health Survey wealth index and assigned clients to a wealth quintile based on their responses to asset questions. Lastly, household consumption questions in the survey were used to calculate the economic burden of direct costs (out-of-pocket expenditure and direct transport costs). The direct client costs as a percentage of monthly household discretionary spending (non-food and non-tax) served to represent the economic burden to the client.

Above-Site Expenditure

To capture the above-site costs that occur within government administration levels, a top-down approach was applied using data from PEPFAR's Resource Alignment initiative, which includes expenditure reporting from PEPFAR, the Global Fund, and the government of Tanzania. Here it was assumed that expenditures are equal to costs. The U.S. Global AIDS Coordinator conducted this analysis led by Elan Reuban of USAID. Expenditures include resources spent on activities related to policy, governance, health systems administration, coordination, and training. The PEPFAR resource alignment tool also tracks program

management and non-service delivery expenditures. Examples of site-level non-service delivery activities include clinical mentoring, supportive supervision, and training.

To analyze above-site figures, budgets and spending reported in the PEPFAR resource alignment tool were disaggregated by funder, program area, and interaction type. This process was done twice: with commodities and also without commodities for comparison. Above-site budgets and expenditures were allocated to prevention, testing, and care and treatment based on the proportion of site-level expenditures that were allocated to each of these programs. For HTC and HIV care and treatment, the allocated above-site budgets and expenditures were then divided by the number of people tested and the number of people receiving care and treatment from the period of October 2019 to September 2020 to estimate the budget and spending per person tested and per person receiving treatment. Estimates for the number of people receiving prevention services annually were not available.

Sampling Approach

Facility sites were purposively selected to include facilities operating for at least two years and providing at least four of the core HIV services included in the study. A fully representative sample was not feasible, given time and resource constraints. Twenty-two facilities representing a cross section of characteristics with variations in geography, setting (urban or rural), facility type (district hospital, health centre, or dispensary), funder (PEPFAR or government of Tanzania), and sector (public or private/nongovernmental organization) were selected using the data collected from the ecosystem mapping exercise.

Six regions (Dodoma, Kagera, Mbeya, Mwanza, Njombe, and Tabora) were randomly selected from the four national geographic zones with the highest HIV prevalence (see Annex C for the distribution of facility characteristics in the sample). Zones with high disease burdens were prioritized because these areas would require a higher proportion of HIV resources and also to achieve an adequate sample size for each HIV intervention. Dar es Salaam was automatically selected due to its unique characteristics and the fact that it represents 16 percent of all patients currently on ART. Two to four facilities in different councils from each of the sampled regions were selected randomly with different HIV treatment patient volume criteria based on three tiers: low (20–249 patients), medium (250–1,249 patients), and high (1,250+ patients). The facilities were then cross-checked with services offered (HTC, PMTCT, PrEP, and VMMC). Selected facilities with characteristics that were over-represented were replaced as needed to arrive at the targeted distribution criteria.

The patient sample comprised adult patients (18 years and over, even for VMMC) accessing the services to be costed using ABC/M. The inclusion of pediatric patients in the study would have required a longer ethical review process, which was not possible with the given timeline. Participants were identified during patient registration upon entering the facility. Potential participant patients were informed of the study objectives, asked if they would like to participate, and presented with a consent form. If consent was given, each patient was assigned a unique ID for the study and the tracking process began. To ensure confidentiality, names and other identifiable information of the client were not collected.

Results

Landscape Assessment

Ecosystem Mapping

There are about 9,100 total health facilities in Tanzania, of which roughly 72 percent offer at least HTC services, while 2,236 facilities (25 percent) offer ART services. Roughly 40 percent (2,561) of the facilities that offer HIV services are PEPFAR-supported. The rural/urban split in Tanzania is roughly 60 percent rural and 40 percent urban. Table 2 shows a breakdown of facility types and ownership.

Table 2. Disaggregation of Facilities that Provide HIV Services by Facility Type and Ownership

Category	Type	%
Facility Type	Dispensary	83%
	Health centre	12%
	District hospital	3%
	Secondary or tertiary hospital	1%
	Other	1%
Ownership Type	Private, for-profit	5%
	Private, faith-based nongovernmental organization	12%
	Public	83%

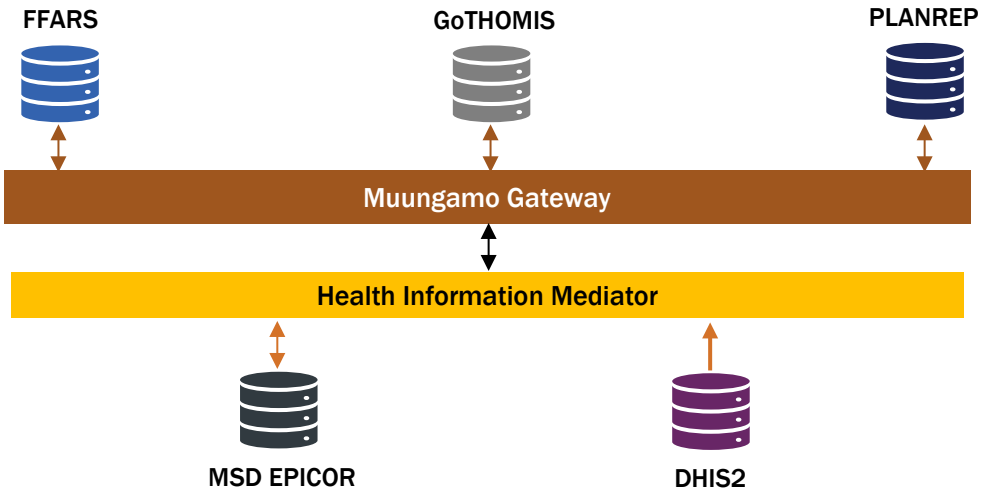
Source: MOHCDGEC, 2020

In general, HIV services are not well-integrated in Tanzania, meaning they do not use existing fixed and operational capacity and are shifted to provision at the lowest and most cost-effective level of the system. HIV testing and counseling services are stand-alone services not fully integrated with other primary healthcare services.

Data Systems Assessment

Figure 2 maps some of the main healthcare data systems in Tanzania, which are elaborated on further in this section.

Figure 2. Data Systems in Tanzania



Adapted from Public Sector Systems Strengthening Plus, 2021

Clinical Data

A health information system focal person collects data every day on patient volumes at every public health facility (not just those that are PEPFAR-funded)—either on paper or in the electronic Government of Tanzania Health Operations Management Information System (GoTHOMIS). There is also a GoTHOMIS Lite mobile app version intended for use by dispensaries that don't have IT infrastructure and connectivity. Vertical programs such as HIV, tuberculosis, and malaria have separate registers. These forms are consolidated monthly at the district level and entered into the DHIS2. GoTHOMIS, the DHIS2, and National Health Insurance Fund claims management are interoperable to enable better financial and clinical management. For HIV, clinical outcomes for ART, HTC, VMMC, and CD4 and viral load tests are collected, although viral load tests are not available at lower-level facilities. This data is used to quantify commodities and to develop budgets once per year, with a review every six months. Data is also analyzed for planning programs, developing education campaigns for specific diseases, and researching the effectiveness of interventions. Costs of services are not linked directly to the health management information system. Private facilities may have their own supplemental systems but are required by law to use the DHIS2.

Financial Management Data

The in-country data systems for financial management data include the following:

- **Planning and Reporting System (PlanRep)**: This is a system for the President's Office – Regional Administration and Local Government (PO-RALG), Local Government Authority (LGA), and facility-level planning, budgeting, and reporting, redesigned and made interoperable with the LGA Integrated Financial Management System (Mfumo wa Malipo Serikalini [MUSE] accounting system), the Local Government Revenue Collection Information System (LGRCIS), and the Facility Financial Accounting and Reporting System (FFARS).
- **Central Budget Management Information System**: The MOFP national budgeting system and a number of other MOFP systems and gateways are used in public finance management (for example, the Government Electronic Payment Gateway [GePG]). Preliminary discussions are underway to make PlanRep interoperable with MOFP systems or to implement PlanRep nationally.
- **FFARS**: PO-RALG's key facility-level financial data system for accounting and reporting. There are three versions—web-based, a mobile app for remote facilities, and a manual version for those unable or not yet using the mobile app. All revenue and expenditures flowing through a facility bank account is accounted for by FFARS and enables PO-RALG, LGAs, and the MOFP to disburse budget allocations directly to even the lowest health facility levels in the country.
- **Epicor**: An LGA-level accounting system that is used by the Medical Stores Department (MSD), which is the government institution that manages the procurement, storage, and distribution of medicines and medical supplies. MSD Epicor and FFARS are interoperable so that facilities can see their balances in the national budget and better manage drug procurement. There are different bank accounts for FFARS and Epicor.
- **LGRCIS–PO-RALG system**: This system electronically collects revenue at the LGA and PO-RALG levels to monitor the collection process.

Systems Functionality

Most systems are now electronic, either web-based or through a mobile app. Only the most remote health facilities with very little IT infrastructure or connectivity are still using paper forms. Recently strengthened and interoperable public financial management systems implemented nationwide are user-friendly with user support provided to maximize routine use.

FFARS shows different funding source contributions at the facility level and both LGA MUSE and FFARS capture all expenditures made at LGA and facility levels. In dispensaries and most health centres, HIV-specific expenditures are not collected or aggregated at the transaction level because most of the costs, especially labor and supplies, are not separated by disease/condition at that level. Allocation to HIV would require an assumption added to the chart of accounts for costs collected for most line items (e.g., salaries, supplies, drugs, fuel, and utilities). The likely best candidate for computing this allocation would be time spent by health facility staff on patients disaggregated by disease (including finding some formula to disaggregate single visits that address more than one disease). It is possible to pool HIV-specific activities into an "objective" in the FFARS system to track HIV expenditure more accurately. However, some HIV-related expenditures may be missed if they are charged within other objectives in the system.

Data Uses

In Tanzania Mainland (excluding Zanzibar), 99.6 percent of health facilities report financial information in FFARS. The Muungano Gateway facilitates data exchange across systems but does not store the data or information, which is stored in a central PO-RALG server. The MOHCDGEC Health Information Mediator is another gateway to facilitate data exchange to integrated systems such as PlanRep. Data is used for reporting and monitoring continuously as facilities analyze their own data to make financial decisions, including procurement. Higher levels of government are beginning to analyze FFARS data across facilities.

System Upgrade Recommendations

As mentioned, for FFARS and MUSE to disaggregate HIV-specific expenditure requires "allocation keys" that describe how HIV expenditures should be pooled into "objectives" in the systems. Results from ABC/M that document staff time at dispensaries and health centres by disease could be used to estimate a ratio to allocate costs for HIV. Failure to collect costs or aggregate HIV-specific costs or expenditure at the patient level is not due to a weakness in the system, but rather due to the nature of health services and the discipline of accounting. Hospitals or specialized clinics might be better able to collect HIV costs and expenditures at the accounting transaction level if activity-level reporting is added into FFARS. Once granular statistical allocations are developed, FFARS could automatically produce a routine HIV cost report using the basic expenditure data and cost allocations. No additional investments would be needed in FFARS and MUSE beyond what is already required to support, manage, maintain, and refine the system for all uses.

Facility-Level Results

Data were collected for 1,197 patients followed through care visits at the facility-level using the TDABC approach (see Annex Table D1 for the patient sample size by HIV intervention and facility type). Demand-generation activities for VMMC at the community-level were halted because of the COVID-19 pandemic, which explains the lower-than-expected patient volumes for this service. Meanwhile, rollout of PrEP in Tanzania was still in the early

implementation stages at the time of the study and was further limited by COVID-19, explaining the small sample size for PrEP clients.

Observations from Patient-Following/Time Motion

The average time spent at the facility per patient, per care visit, and the average time that patients were in direct contact with service providers per visit is shown in Table 3. For example, the average ART-new patients spent 89 minutes at the facility per visit, while the average time ART-new patients were in direct contact with a service provider was only 57 minutes per visit. Meanwhile, ART-stable and ART-unstable patients spent an average of only 20 and 21 minutes, respectively, in direct contact with service providers. Unstable patients report incurring the highest percentage of time (45 percent) spent waiting, compared to ART-new patients (29 percent) and ART-stable patients (43 percent).

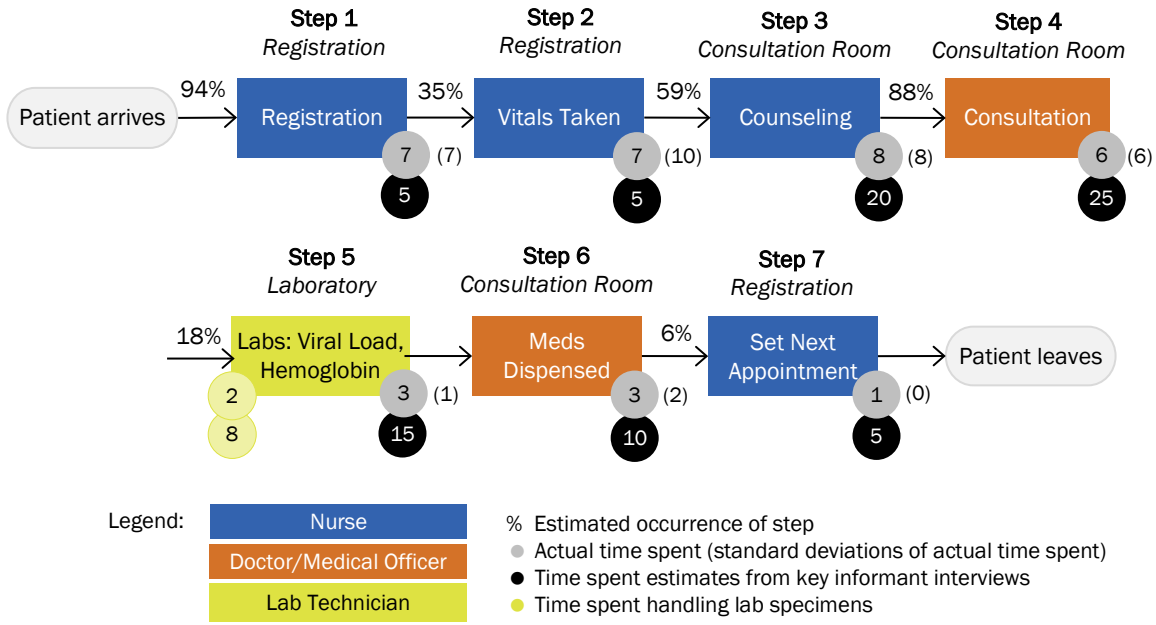
Table 3. Average Time in Minutes per Care Visit by HIV Intervention and Facility Types

HIV Intervention/ Facility Type	Average Clinical Time with Provider	*Standard Deviation*	Average Time Spent at Facility	*Standard Deviation*	Average % of Time at Facility Waiting
HTC	26	*19*	46	*42*	31%
Dispensary	33	*29*	68	*60*	44%
Health Centre	24	*14*	45	*38*	36%
Hospital	25	*13*	32	*22*	17%
ART-New	57	*27*	89	*49*	29%
Dispensary	22	*11*	29	*22*	14%
Health Centre	51	*19*	83	*43*	31%
Hospital	72	*25*	110	*46*	31%
ART-Stable	20	*17*	46	*45*	43%
Dispensary	16	*11*	32	*27*	35%
Health Centre	19	*15*	48	*47*	47%
Hospital	25	*21*	53	*50*	44%
ART-Unstable	21	*16*	51	*44*	45%
Dispensary	15	*12*	29	*33*	31%
Health Centre	20	*14*	51	*36*	51%
Hospital	27	*18*	64	*52*	46%
PMTCT	25	*19*	57	*72*	36%
Dispensary	20	*12*	58	*75*	37%
Health Centre	18	*15*	45	*54*	41%
Hospital	34	*24*	70	*86*	30%
PrEP	15	*16*	20	*21*	20%
Health Centre	15	*16*	20	*21*	20%
VMMC	79	*20*	105	*40*	20%
Health Centre	57	*14*	68	*15*	16%
Hospital	89	*13*	121	*37*	22%
Overall Average	28	*24*	55	*53*	37%

Source: HP+ calculations

Examining the process maps for each of the HIV interventions reveals the sequence of care provision, how much time the provider is spending on each step in the care visit, what cadre is providing care, and the location of the service. These figures show significant variation in care, even within a facility, from patient to patient. For example, at Magomeni Health Centre, certain steps in the care process do not always occur for unstable ART patients. Take counseling, which was only performed for 59 percent of the patients followed (see Figure 3 and Annex Figure D1 for process map conventions). Key informant interviews with providers also reveal that there are differences in the way services are delivered in practice compared with the protocols described. For example, consultations that protocols estimate will take 25 minutes are frequently completed in less than 10 minutes in practice.

Figure 3. Process Map of HIV Treatment for Unstable Patients at Magomeni Health Centre



Source: HP+ calculations
See Annex Figure D1 for full process map conventions/legend.

Interestingly, there was not much difference in the observed time clinicians spend with stable versus unstable ART patients, and the research team observed that unstable ART patients are treated very similarly to stable patients. This is contrary to the MOHCDGEC guidelines for ART, which state that unstable ART patients are supposed to receive lab tests at each visit—in practice these tests often do not occur for unstable patients at facilities. In some cases, certain steps are skipped completely. For example, at Mahaha Dispensary, viral load tests for unstable patients were not administered. Generally, it was seen that providers at district hospitals spent more time with clients than providers at lower-level facilities, possibly because these patients represent more complex cases or because the provider-to-patient ratio is much lower, allowing providers more time for patient interaction. The shorter patient contact time at lower-level facilities may also indicate quality-of-care issues.

Table 4 provides the percentages that certain services occurred per HIV intervention across facilities. Note that not all services are expected to occur for every facility visit. For example, ART-stable patients are not expected to receive lab tests at every visit and HTC clients are not expected to be dispensed medications. However, the expectation for "new" and "unstable" ART patients, according to protocols, is to receive counseling and laboratory tests

100 percent of the time and all ART patients should receive their medications 100 percent of the time. The reasons underpinning departures from standardized or expected protocols are largely unknown, but this will be part of the focus of ABC/M Phase 2.

Table 4. Percentage Occurrence of Service per HIV Intervention

Service	ART New	ART Stable	ART Unstable	PMTCT	HTC	VMMC	PrEP
Number of patients tracked	111	281	264	233	246	45	16
Lab tests performed	84%	21%	25%	31%	97%	53%	38%
Medication dispensed	93%	99%	98%	99%	0%	29%	100%
Counseling	86%	19%	14%	28%	76%	98%	56%

Source: HP+ calculations

Unit Costs of Patient Care Visit per HIV Intervention and Cost Drivers

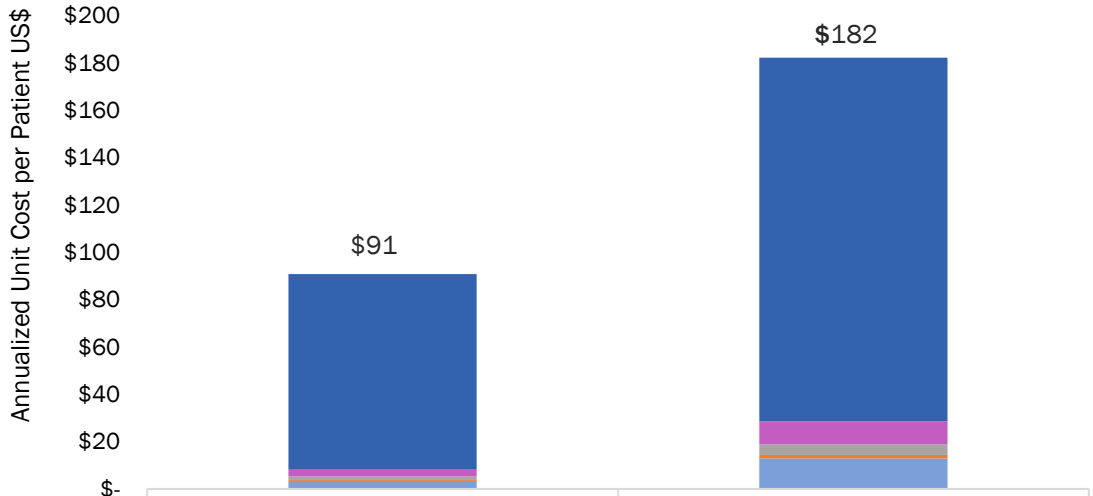
Figure 4 shows the average facility-level unit cost in Tanzania, disaggregated by HIV intervention. The unit cost stacks are further disaggregated by cost category. The range of unit costs per intervention are marked by a maximum and minimum data point found across the 30 facilities sampled. Note that the lower unit cost per visit for unstable ART patients does not suggest that these patients cost less overall to treat, but rather the lower unit cost is balanced by more frequent visits throughout the year. The annualized unit cost is shown in Figure 5. The annualized unit cost assumes an average of four facility visits per year for a stable patient—this is based on three months of ARV prescriptions observed during the data collection process. Unstable ART patients are expected to make a facility visit once per month and therefore are only typically provided a one-month supply of ARVs. Unit costs weighted by patient volume are shown in Annex Figure D2. There are no significant differences between the unweighted and weighted unit costs.

Figure 4. Average Unit Cost per Facility Visit

	ART New	ART Stable	ART Unstable	PMTCT	HTC	VMMC	PrEP
Consumables	$19.68	$20.65	$12.80	$20.04	$2.67	$27.24	$5.73
Equipment	$0.07	$0.69	$0.81	$1.08	$0.00	$0.00	$0.00
Indirects	$0.84	$0.38	$0.38	$0.47	$0.52	$0.90	$0.26
Facility	$0.36	$0.10	$0.13	$0.13	$0.10	$0.43	$0.03
Personnel	$4.58	$0.86	$1.07	$2.02	$1.28	$4.10	$0.79
Max	$38.46	$30.82	$23.23	$53.05	$7.52	$40.47	$7.02
Min	$4.92	$18.01	$9.62	$9.20	$3.43	$23.12	$6.68

Source: HP+ calculations

Figure 5. Average Annualized Unit Cost per Patient



	ART Stable	ART Unstable
Consumables	$82.61	$153.54
Equipment	$2.76	$9.77
Indirects	$1.52	$4.50
Facility	$0.41	$1.50
Personnel	$3.43	$12.83

Source: HP+ calculations

Consumables represent 84 percent of the overall cost for service delivery at the facility level across HIV interventions, with ARVs and lab tests being the largest cost driver. Commodities (other than ARVs) are centrally procured from the Medical Stores Department, so prices are homogenous. ARVs are purchased through the Global Fund's pooled procurement process. Unlike in high-income countries, personnel costs are low as a proportion of total costs, representing 9 percent of facility-level costs. The capacity cost rate for even the highest health cadre (i.e., medical doctors) is only US$0.08 per minute, on average, while the lowest capacity cost rate by cadre is for community health workers and receptionists at US$0.01 per minute. See Annex Table D2 for key inputs in the personnel capacity cost rate.

There is significant variation in self-reported staff compensation and practical capacity (the annual cost of a resource divided by how often, in minutes, the resource can be used annually) within each cadre, with nurses displaying the widest range. As expected, the capacity cost rates are larger in higher-level facilities, such as district hospitals. Minor variations among regions could be explained by the ability to attract and retain high-skills workers in more desirable postings in urban centers, compared to those working in mostly rural regions. Costs for lab specimen handling by lab technicians were a significant driver of personnel costs—in part because often the personnel time required for handling lab specimens exceeds the time patients spend with clinicians during their care visit.

The capacity cost rate for facility space and rooms used in the care visit (including common furniture and equipment in the rooms) was largely below US$0.01/minute in Tanzania. Capacity cost rate calculations for equipment used directly for service delivery were necessary only for lab machines. Data were also sourced from central lab processing sites because most viral load tests are shipped to these sites. Facility and equipment capacity cost rates were calculated using estimates for their practical maximum capacities, not their actual time in use, so they do not factor in underutilization of facility and equipment resources. But facility (1 percent) and equipment (3 percent) costs were very small proportions of the total

costs, so although underutilization was not captured in the calculation, this has little impact on the overall unit costs. Facility indirect capacity cost rates were calculated based on annual operating expenses and the number of outpatient and inpatient visits per year, assuming that the duration of an average outpatient visit was the same as a typical ART visit. See Annex Table D3 for indirect cost calculations. Dispensaries reported the highest capacity cost rates for indirect costs, despite having significantly lower operating expenses in some cases. This is because high operating expenditures at larger facilities were offset by higher patient utilization in the indirect capacity cost rate calculation.

Effect of Absenteeism and Idle Time on Costs

During the course of data collection, data collectors observed some absenteeism of providers. Additionally, the amount of healthcare worker idle time (time spent on breaks, lunch, etc.) was self-reported by service providers and estimates may have been underrepresented. Lower patient volumes due to COVID-19 may also have contributed to increased idle time of providers, especially for VMMC and PrEP.

To examine the potential effect of absenteeism and increased idle time, HP+ quantified the value of the time that could have been used for providing clinical care but was otherwise left unused due to this behavior. These calculations were derived from TDABC data combined with sourced published literature from Tanzania that estimated the percentage of time that clinicians are idle or absent when they are supposed to be providing services. A study from 2018 used survey data and estimated this percentage to be 27 percent (Fujii, 2018) while a study from 2012 that combined interviewing health facility workers with time-motion tracking estimated the percentage as 56 percent (Manzi et al., 2012). Using these estimates, HP+ calculated how these scenarios may affect the personnel capacity cost rate and thus impact unit cost calculations. The difference in unit costs serves as an estimate for the value of unutilized practical capacity due to absenteeism and idle time (see Table 5). The calculation with 56 percent idle time represents a worst-case scenario.

Table 5. Scenario Analysis Factoring Assumptions on Personnel Inefficiencies

Scenario	Measurement	ART New	ART Stable	ART Unstable	PMTCT	HTC	VMMC	PrEP
Baseline	Unit cost per visit	$25.52	$22.68	$15.18	$23.75	$4.56	$32.68	$6.81
27% idle time	Cost of idle time per visit	$1.35	$0.25	$0.19	$0.54	$0.41	$1.17	$0.26
	% increase in personnel costs	29%	29%	29%	27%	31%	27%	33%
	% increase in total cost per visit	5%	1%	1%	2%	9%	4%	4%
	New unit cost	$26.87	$22.93	$15.37	$24.29	$4.97	$33.85	$7.07
56% idle time	Cost of idle time per visit	$6.28	$1.29	$1.39	$2.66	$2.09	$5.71	$1.18
	% increase in personnel costs	137%	150%	142%	132%	162%	138%	150%
	% increase in total cost per visit	25%	6%	9%	11%	46%	17%	17%
	New unit cost	$31.80	$23.97	$16.57	$26.41	$6.65	$38.39	$7.99

Source: Fujii, 2018; Manzi et al., 2012; HP+ calculations

Time Spent by HIV Service Providers on Non-HIV Service Delivery

During interviews with HIV service providers, HP+ asked if staff were hired to be dedicated providers of HIV services. Among those who affirmed that they were dedicated providers, HP+ asked if they nevertheless contributed to non-HIV care. If yes, they were then asked to estimate their time spent on non-HIV service delivery. Seventy-eight service providers, or 24 percent of the providers interviewed, indicated that they were HIV-specific providers that regularly provided non-HIV service delivery. On average, these providers spent 2.7 hours per day (32 percent of their time at the facility) on non-HIV service delivery (see Table 6). Based on this, HP+ concludes that there is some cross-subsidization of non-HIV services. However, the extent of PEPFAR cross-subsidization could not be calculated because HP+ was not able to determine whether providers were specifically supported by PEPFAR only, partially supported by PEPFAR, or supported by the government. This question will be asked in subsequent applications of ABC/M.

Table 6. Time Spent by HIV-Specific Providers on Non-HIV Service Delivery

Cadre	n	Averages per Day			
		Work Hours	Clinical Hours	Clinical Hours on HIV Services	Clinical Hours on Non-HIV Services
Doctor	6	8.7	7.3	5.3	2.0
Assistant medical officer	5	8.8	6.8	2.8	4.0
Clinical officer	9	9.1	7.6	3.2	4.4
Nurse	26	8.2	6.7	4.4	2.3
Counselor	1	8.0	7.0	5.0	2.0
Medical attendant	4	8.0	6.5	5.1	1.4
Pharmacist	3	8.0	6.3	4.0	2.3
Lab technician	9	9.6	8.1	4.5	3.6
Data clerk	5	8.8	7.6	6.8	0.8
Receptionist	4	8.3	7.1	1.4	5.7
Community health worker	6	8.0	6.4	5.7	0.8

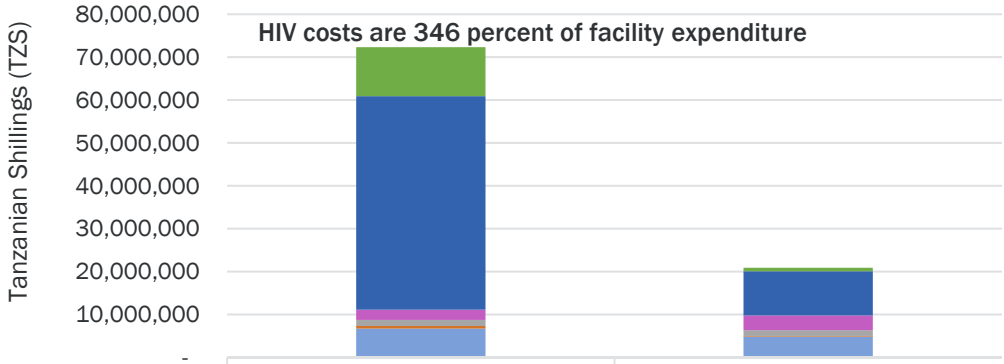
Source: HP+ calculations

Ratio of HIV Expenditure to Total Facility Expenditure

USAID's Public Sector Systems Strengthening activity worked with the government of Tanzania to obtain budget, revenue, and expenditure data from the facility-level accounting system FFARS for health centre-level and dispensary-level sites in the sample. HP+ used TDABC unit costs and utilization data from the DHIS2 to estimate the ratio of HIV expenditure to total facility expenditure over a 12-month period. The estimated ratio was 346 percent (see Figure 6). The largest HIV cost-drivers (ARVs, HIV test kits, and lab consumables) are largely procured directly by donors but are not being captured in facility revenue and expenditure records. This creates a mismatch when comparing annual HIV costs versus facility expenditure as captured in FFARS. It is also difficult to tell the extent to which different funding streams—for example, National Health Insurance Fund and Improved Community Health Fund reimbursements, direct-to-facility financing, LGA own-source financing, government of Tanzania budget allocations, and donor funding—

contribute to resources consumed at the facility for human resources for health, commodities, and non-service delivery support. That is because this specific data is not clearly captured in the financial management systems. Given the large mismatch between the value of resources consumed, determined by purchase price, and facility expenditure recorded in FFARS, it appears that much of this financing is not recorded in the financial management system—a fact that makes estimating the HIV portion of total facility expenditure using ABC/M cost data a significant reconciliation challenge.

Figure 6. Estimated HIV Costs as a Percentage of Total Facility Expenditure



	HIV Cost	Facility Expenditure
Other Consumables	11,469,801	790,852
ARVs, Labs Consumables, Test Kits	49,717,205	10,295,777
Equipment	2,431,356	3,449,417
Indirects	1,405,132	1,342,650
Facility Space	605,001	140,000
Personnel	6,737,599	4,889,000

Source: PO-RALG, 2021; HP+ calculations

Community-Level Results

Based on interviews with implementing partners operating at the community level in the same catchment areas of the ABC/M facilities sample, HP+ determined that the unit cost for care and treatment support services at the community level per client reached was US$23.37 (see Table 7). This includes activities such as adherence counseling, peer support, and lost-to-follow-up tracking. The unit cost excluding non-service delivery expenditures is US$14.56; further excluding program management expenditure reduces the unit cost to US$11.24. A 2019 analysis estimated community-level care and treatment support services to be US$19.49 per client reached (Forsythe et al., 2019).

Table 7. Unit Cost of Community-Level Care and Treatment Support Services

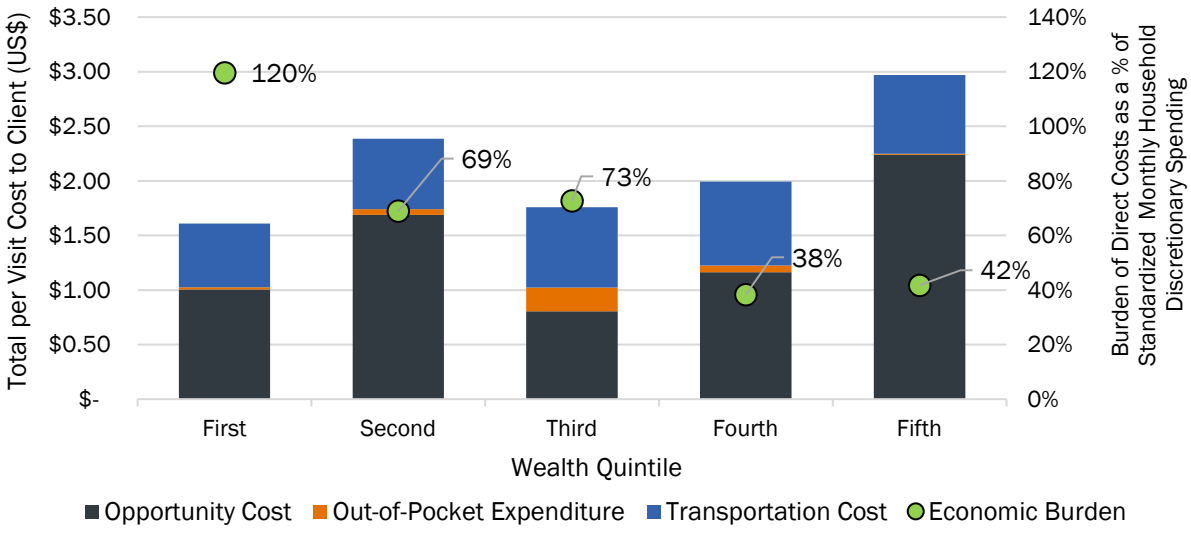
Calculation	Result
Programs costed (n)	7
Unit cost, community-based care and treatment (US$)	$23.37
Non-service delivery/total expenditures	37%
Unit cost (excluding non-service delivery) (US$)	$14.56
Program management/total expenditure	23%
Unit cost of service delivery (excluding program management) (US$)	$11.24

Source: HP+ calculations

Client Survey Analysis

Using data collected from a client exit survey, HP+ quantified the cost borne by the patient per care visit (see Figure 7). Demographics of the patients surveyed can be found in Annex Table D4. Out-of-pocket expenditures to receive HIV services in Tanzania are very low. However, clients do incur substantial transportation and opportunity costs for facility visits. This is particularly the case for patients who must come to the facility every month, such as unstable ART patients. In the lowest income quintile, the economic burden of these costs is significant, quantified as 120 percent of monthly household discretionary spending. This suggests that transportation and opportunity costs may represent a major barrier for facility visits. The client survey also revealed that 94 percent of respondents were very satisfied with the services they received. There did not appear to be a relationship between client satisfaction and the cost of services borne by the client.

Figure 7. Total per Visit Cost to the Client and Burden of Direct Costs by Wealth Quintile



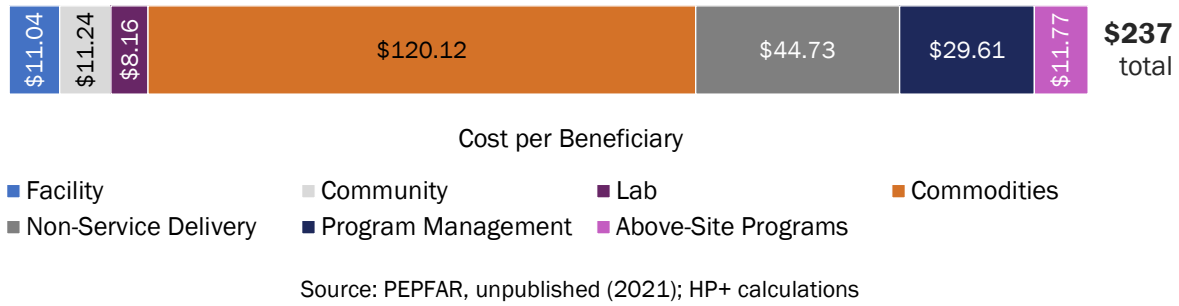
Source: HP+ calculations

Above-Site Expenditures

The ABC/M application aims to understand the full cost of an intervention, across all elements of the HIV program: facility-level, community-level, laboratory, commodity, non-service delivery, program management, and above-site costs. Figure 8 shows data for a patient on ART. The cost figures represent an amount that has to be spent to secure the resources necessary for generating a service.

The PEPFAR Resource Alignment initiative provides above-site, non-service delivery, and program management data for both the budget and spend annually for PEPFAR, the Global Fund, and the government of Tanzania. Program activities at the above-site level include health administration, policy, governance, systems strengthening, and training. Given that the PEPFAR resource alignment tool does not report on cost, HP+ assumed that spending will equal cost for above-site, non-service delivery, and program management. The facility-level, laboratory, and commodity costs were derived from TDABC. Community-level costs were derived using the community-level methods described earlier.

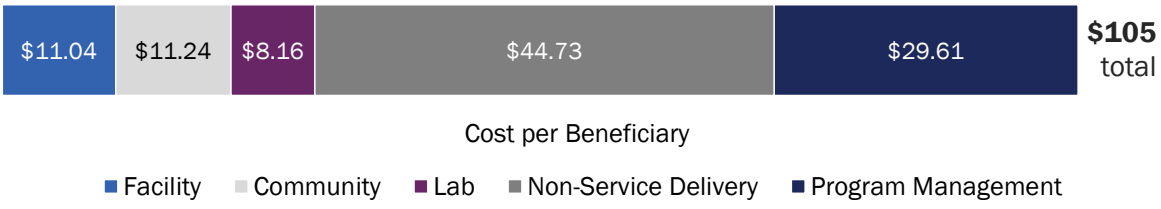
Figure 8. Annual Cost per Patient on ART



Source: PEPFAR, unpublished (2021); HP+ calculations

In order to focus on what is happening with regard to service delivery and program oversight, it's possible to compare costs across line items, excluding above-site and commodity costs (see Figure 9). In Tanzania, the facility costs per patient on ART are much lower than the spending reported in the PEPFAR resource alignment tool. This could be explained by a number of factors, including inefficiencies and cross-subsidization of HIV-specific funding to non-HIV programs. More exploration is required to understand why facility-level costs and spending are so different.

Figure 9. Annual Cost per Patient on ART, Excluding Above-Site and Commodity Costs

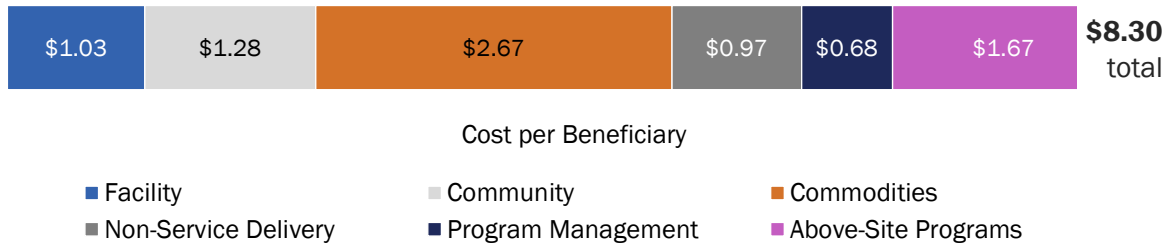


Source: PEPFAR, unpublished (2021); HP+ calculations

Figure 10 shows the full cost of HTC, including both facility-based and community-based components. Although the facility and community costs are shown in the figure as cumulative, they are actually substitutes for one another—these costs were weighted assuming that 54 percent of clients receive testing at facility-based testing sites and 46 percent of clients receive testing at community-based testing sites. This ratio was derived from data in the PEPFAR resource alignment tool. For the most part, spending reported from the PEPFAR resource alignment tool and the cost figures were similar, except for testing commodities. One reason for this difference in Tanzania is that commodities were purchased in the prior fiscal year but were not consumed in the same year. In this case, the costs included money paid for test kits that were not used in the same year, which would inflate the unit cost on commodities during the year they were purchased and deflate them during the year they were consumed. After excluding above-site costs and commodities (see Figure 11), the cost is US$3.96 per person tested.

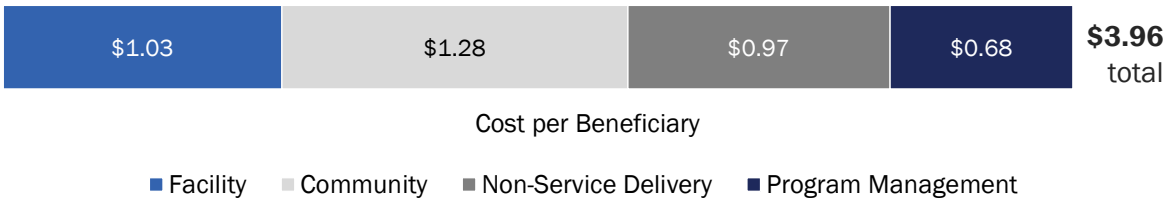
Figures showing the disaggregation of the full cost (both inclusive and exclusive of above-site and commodity figures) for VMMC and PrEP can be found in Annex E. Due to COVID-19, uptake of VMMC was significantly lower, which could have resulted in significant idle time of providers and could explain differences between spending and cost. Differences in figures for PrEP are primarily because PrEP commodities, namely ARVs, could not be extracted from the spending analysis.

Figure 10. Cost per Person Tested for HIV



Source: PEPFAR, unpublished (2021); HP+ calculations

Figure 11. Cost per Person Tested for HIV, Excluding Above-Site and Commodities



Source: PEPFAR, unpublished (2021); HP+ calculations

It is important to understand all levels of costs, and not only facility-level costs. In some cases, above-site, non-service delivery, and program management costs comprised more than half of all costs. Focusing only on facility-level costs misses important areas for potential cost savings, efficiency gains, and opportunities to discuss sustainability. More complete understanding of the allocation and spending for site level/non-service delivery activities in the context of the Tanzania program may surface key insights.

Discussion and Recommendations

Summary of Major Takeaways from Data Collected

Variations in Service Delivery Processes

Given the significant variations observed within and across facilities in the way services are delivered, it will be important to get clinical leadership's interpretation of the data to understand the root causes of the outputs observed. Possible explanations for why steps were skipped or time allocations were lower than expected include: facilities did not have the resources to provide the optimal level of services, healthcare workers did not have time because they were overburdened (or else were absent), lab machines were broken or lacked electricity to operate, or providers delivering care were unaware of standard protocols or clinical guidelines. It is also possible that, in some cases, variation could be a result of a clinical determination that specific patients did not actually need certain aspects of care, such as lab work. An activity under ABC/M Phase 2 is to present process maps to HIV program leaders. HP+ will interview these clinical experts to get their opinions on the root causes for why observed pathways departed from prescribed pathways.

Potential for Cost Savings

The analysis showed that above-site expenditures are a significant portion of the overall costs for providing HIV services. Above-site costs are mostly funded by donors—namely

PEPFAR and the Global Fund—to build systems and improve quality of care through training and supportive supervision. Ideally, some of these costs will not be needed in the future as health systems are strengthened and some programs are taken over by the government of Tanzania. Still, understanding the key drivers of the above-site costs to better prioritize investments may offer the potential for cost savings when planning for the future HIV funding landscape.

Opportunities for Efficiency Gains

While not captured in the expenditure assessments, there is anecdotal evidence that donor funding results in additional positive health benefits. Even when a healthcare worker is ostensibly hired only for HIV work, they provide practical support for non-HIV service delivery, consequently producing additional benefits to the health system. There appears to be some level of cross-subsidization happening that may inform opportunities for efficiency gains from a more integrated health system.

Meanwhile, more insight into the extent of absenteeism and idle clinical capacity would enable administrators to determine whether new systems should be established to minimize these occurrences. Focusing on these issues can help determine if wages provide adequate incentive for healthcare workers to show up every day.

At the facility level, commodities for ARVs and labs are the main drivers of cost. Continued focus on the supply chain to reduce procurement bottlenecks and strengthen the government's ability to negotiate lower prices for commodities will be an important aspect of efficiency gains, both now and in the future.

Finally, outputs from the client survey showed that direct transport and opportunity costs borne by the patient to visit the facility are a significant burden, especially for those with the lowest incomes, highlighting the importance of differentiated care that removes barriers to access HIV services. For stable patients, there is not much margin to reduce costs further at the facility level. However, longer multi-month prescriptions and decentralizing ARV pick-up points should represent an opportunity to reduce the number of times that clients are required to visit facilities where they often spend a long time waiting for services.

Obstacles to Implementation

Applying TDABC at the facility level is a labor- and time-intensive process. The resources required for data collection to measure facility and room sizes and to collect data on the replacement cost, useful life, and annual maintenance costs for common furniture and equipment should be weighed against the benefit of remaining consistent with the TDABC method for future exercises in low- and middle-income countries. However, the ABC/M effort represents a capital investment that has laid groundwork for a much more streamlined process if replicated at future dates. For example, data collection tools, training materials, and analytic spreadsheets are all readily available for use. Process maps do not need to be reproduced from scratch, but rather only updated to match the current situation. Collecting TDABC information and updating process maps, although resource- and time-intensive, do not need to be done every year as processes may not change drastically from year to year. Part of moving toward routinely capturing this information would be to define when and how often updates should be made. For example, a logical time to make updates would be after there is an overhaul of protocols and processes.

Applying TDABC or a TDABC "light" at the community-level in future ABC/M exercises could allow direct comparisons between community- and facility-level results; and similar resources could be used to this end. In addition, tracking not only the client but also the provider could provide significant insights regarding the activities undertaken when healthcare providers are not seeing patients needing HIV services. Are these providers absent or are they treating other patients? Are they engaged in nonproductive activities or are they required to spend this time on administrative functions? However, tracking providers in addition to patients would require additional resources. Experts in PEPFAR's human resources for health division may be positioned to carry out such an exercise.

Next Steps

Facility-level, community-level, and above-site-level findings have been disseminated to the steering committees in Tanzania and PEPFAR interagency teams. This constitutes what has been done under ABC/M Phase 1. HP+ will seek further input from program experts to improve understanding of the context for all findings. This will be an ongoing process and will carry over into ABC/M Phase 2.

Strategy for Operationalizing the ABC/M Framework

Phase 2 of ABC/M will focus on the institutionalization of capturing and using regularly collected HIV cost and expenditure data to produce information required for effective and routine decision making. To achieve these objectives, HP+ will:

1. Identify the best use of ABC/M data for HIV-related financial planning and management.
2. Sensitize and build the capacity of key government of Tanzania stakeholders on the use of this data.
3. Advocate for financial systems upgrades to include more granular data on vertical programs, including for HIV.
4. Produce an ABC/M toolkit and conduct additional training to aid and build the capacity of local researchers, including MUHAS, and policy stakeholders on the ABC/M method and its implementation. Included will be a roadmap for rollout of ABC/M Phase 2 over the next several years.
5. Convene a meeting with clinical leadership to discuss and interpret process map outputs from ABC/M Phase 1.

HP+ will work with a range of key stakeholders to roll out Phase 2 of ABC/M. Among the major government stakeholders are the MOHCDGEC, specifically the National AIDS Control Programme, TACAIDS, and PO-RALG. HP+ will engage PEPFAR Tanzania and USAID implementing partners to discuss their interest in helping to implement the activity and provide support for the analysis. MUHAS will be a key stakeholder in capacity building efforts as the organization that was the local research institution lead for ABC/M Phase 1.

HP+ will also facilitate dialogue around the government's interest in updating its existing data systems (FFARS/PlanRep/MUSE) to accommodate potential data from ABC/M. A short brief will be developed to support sensitization and advocacy efforts on the use of ABC/M data. HP+ will collaborate with the Public Sector Systems Strengthening Plus activity to coordinate advocacy and implementation efforts, given the activity's ongoing efforts in this area.

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Annex A: Assumptions

Major assumptions used in the study:

- Facility indirect capacity cost rates were calculated assuming that the duration of an average outpatient visit was the same as an average antiretroviral therapy (ART) visit.
- HP+ applied the service delivery/non-service delivery ratio for care and treatment found in PEPFAR expenditure reporting for each PEPFAR implementing partner to the partner's self-reported community-level expenditures.
- HP+ assumed that the national expenditure reporting data for each implementing partner would be comparable to the expenditure data collected for our analysis, even though the expenditure data collected for ABC/M was focused only on selected regions in the country.
- Above-site budgets and expenditures were allocated to prevention, testing, and care and treatment based on the proportion of site-level expenditures that were allocated to each of these programs.
- Because the PEPFAR resource alignment tool does not report on cost, we assumed that spending will equal cost for above-site programs, non-service delivery, and program management.
- A stable ART patient is assumed to average four facility visits per year based on three months of antiretroviral prescriptions observed from patient following.

Annex B: Example Unit Cost Calculation Table

Table B1. Example of How Unit Cost Stacks Are Calculated: Voluntary Medical Male Circumcision (VMMC), Nzega District Hospital

Step	Sub-process for VMMC	Personnel Type	Time (Min.)	Personnel Capacity Cost Rate	Personnel Cost	Location	Room Cost	Equipment Cost*	Lab Handling Cost	Indirect Cost	Consumables Cost
1	Group counseling	Nurse	27	$0.06	$1.64	Registration	$0.10	$0.00	—	$0.09	$22.46
2	Counseling	Nurse	15	$0.06	$0.91	Registration	$0.05	$0.00	—	$0.05	—
3	Registration	Nurse	2	$0.06	$0.12	Registration	$0.01	$0.00	—	$0.01	—
4	Consultation/vitals taken	Nurse	6	$0.06	$0.36	Registration	$0.02	$0.00	—	$0.02	—
5	HIV rapid test	Nurse	2	$0.06	$0.12	Registration	$0.01	$0.00	$0.46	$0.01	$6.49
6	Pre-operative counseling and PrEP	Nurse	11	$0.06	$0.67	Procedure room	$0.04	$0.00	—	$0.04	—
7	VMMC procedure	Nurse	20	$0.06	$1.22	Procedure room	$0.07	$0.00	—	$0.07	—
8	Post-surgical care	Clinical Officer	32	$0.04	$1.26	Procedure room	$0.10	$0.00	—	$0.11	—
9	Meds dispensed	Clinical Officer	2	$0.04	$0.08	Procedure room	$0.01	$0.00	—	$0.01	$3.46
10	Set next appointment	Clinical Officer	3	$0.04	$0.12	Procedure room	$0.01	$0.00	—	$0.01	—
	TOTAL		**120**		**$6.50**		**$0.42**	**$0.00**	**$0.46**	**$0.42**	**$32.41**

* No equipment used for direct service delivery in this process. Other equipment and furniture included in the room capacity cost rate.
Source: HP+ calculations

Annex C: Facility Characteristics Table

Table C1. Distribution of Facility Characteristics in the Sample (Total=22)

Characteristic	Location/Type	#
Region	Dar es Salaam	3
	Dodoma	3
	Kagera	2
	Mbeya	4
	Mwanza	3
	Njombe	3
	Tabora	4
Facility Type	Dispensary	5
	Health centre	10
	Hospital	7
Urban/Rural	Rural	15
	Urban	7
Public or Private/Faith-Based Organization	Public	19
	Private/faith-based organization	3
Funder	PEPFAR	21
	Government of Tanzania	1
Treatment Volume	High	11
	Medium	7
	Low	4

Source: HP+ calculations

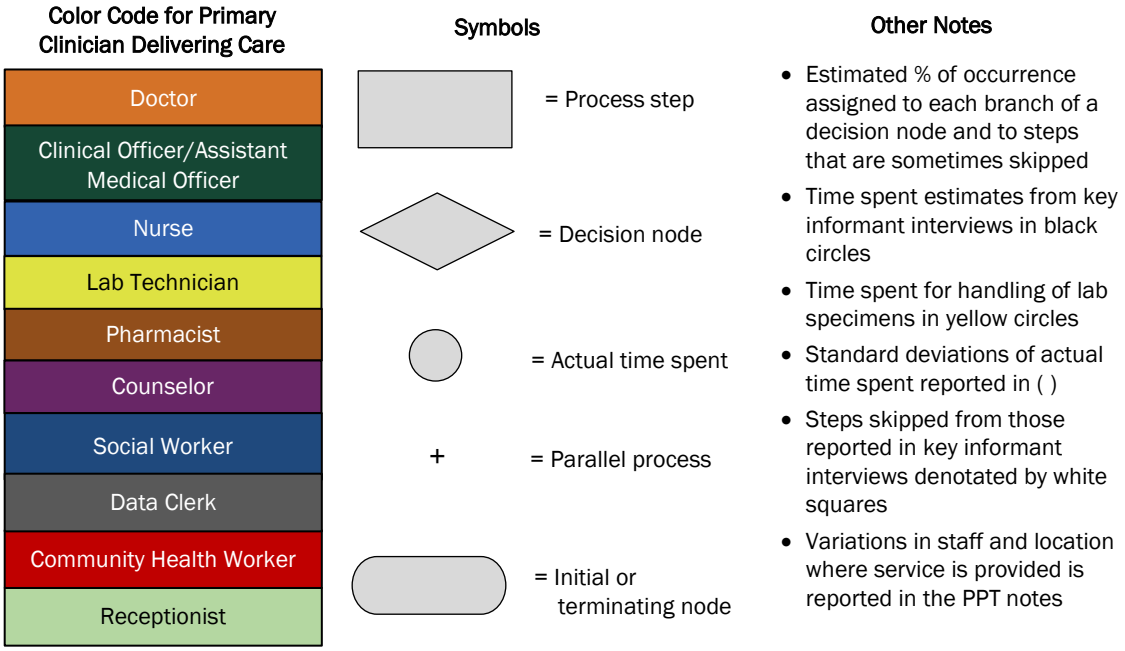
Annex D: Facility-Level Results, Additional Tables and Figures

Table D1. Sample Size of Patients Followed by HIV Intervention and Facility Type

Region/Facility Type	ART-New	ART-Stable	ART-Unstable	PMTCT	HTC	VMMC	PrEP	Total
Dar es Salaam	21	43	46	28	32	0	1	171
Dispensary	1	15	15	5	12	0	0	48
Health Centre	8	16	16	11	11	0	1	63
Hospital	12	12	15	12	9	0	0	60
Dodoma	11	34	37	26	34	0	0	142
Health Centre	7	23	24	14	21	0	0	89
Hospital	4	11	13	12	13	0	0	53
Kagera	6	25	22	21	28	25	0	127
Health Centre	5	13	10	9	16	13	0	66
Hospital	1	12	12	12	12	12	0	61
Mbeya	25	50	39	47	43	6	5	215
Health Centre	14	39	28	36	32	0	5	154
Hospital	11	11	11	11	11	6	0	61
Mwanza	9	37	34	38	30	12	0	160
Dispensary	1	25	22	26	18	0	0	92
Hospital	8	12	12	12	12	12	0	68
Njombe	14	42	39	31	35	0	10	171
Health Centre	10	25	24	16	21	0	10	106
Hospital	4	17	15	15	14	0	0	65
Tabora	24	52	47	43	43	2	0	211
Dispensary	11	25	22	23	26	0	0	107
Health Centre	1	16	12	7	4	1	0	41
Hospital	12	11	13	13	13	1	0	63
TOTAL	110	283	264	234	245	45	16	1,197

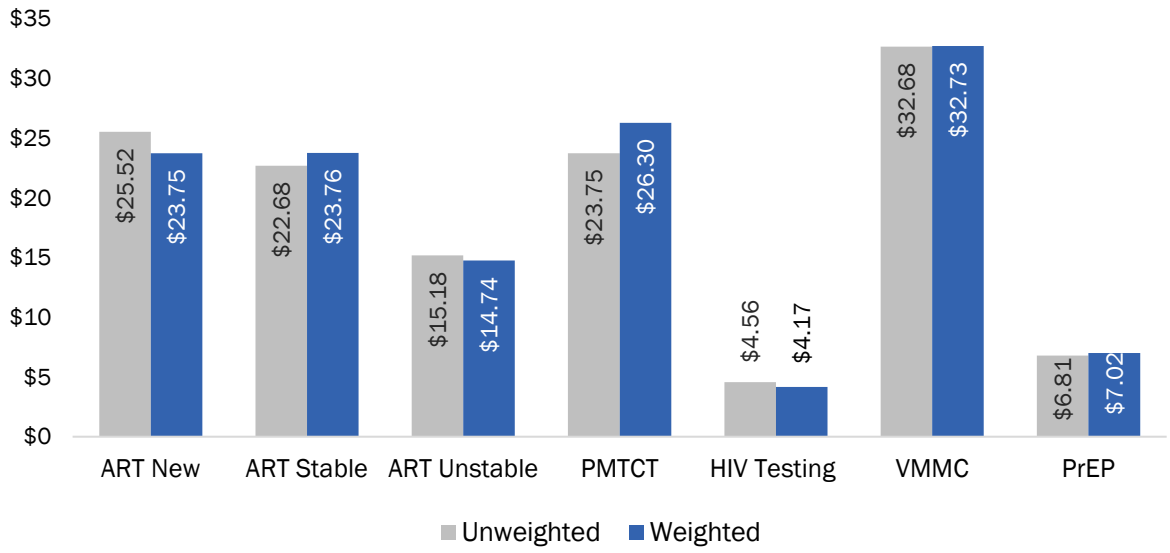
Source: HP+ calculations

Figure D1. Process Map Conventions



Recreated from © Harvard Business School, 2018

Figure D2. Per Visit Unit Cost of HIV Interventions: Weighted Versus Unweighted by Patient Volume



Source: HP+ calculations

Table D2. Key Inputs in the Personnel Capacity Cost Rate Calculation

Cadre	Annual Compensation (TZS)	*Standard Deviation*	Practical Capacity per Year (Min)	*Standard Deviation*	Capacity Cost Rate US$/Min	*Standard Deviation*
Doctor	15,584,444	*6,229,075*	91,516	*34,534*	$0.08	*$0.04*
Assistant medical officer	14,874,909	*9,556,085*	104,752	*19,418*	$0.06	*$0.03*
Clinical officer	11,936,235	*7,746,731*	111,320	*31,556*	$0.05	*$0.02*
Nurse	11,407,275	*4,897,563*	98,284	*17,242*	$0.05	*$0.03*
Pharmacist	10,336,933	*4,614,924*	112,681	*30,985*	$0.04	*$0.02*
Counselor	8,768,667	*4,206,076*	100,769	*26,792*	$0.04	*$0.02*
Lab technician	8,564,739	*3,582,457*	120,551	*26,130*	$0.03	*$0.02*
Data clerk	6,838,318	*1,829,818*	103,385	*21,192*	$0.03	*$0.01*
Medical attendant	4,567,879	*3,154,973*	71,979	*48,775*	$0.04	*$0.02*
Social worker	3,642,000	*3,633,235*	59,502	*14,198*	$0.02	*$0.01*
Receptionist	3,395,290	*2,419,060*	114,011	*32,743*	$0.01	*$0.01*
Community health worker	1,362,931	*454,629*	95,162	*27,752*	$0.01	*$0.00*

Source: HP+ calculations

Table D3. Capacity Cost Rate Calculations for Facility Indirect Costs

Facility Name	Region	Annual Operating Expenditure (TZS)	Annual Outpatient Visits	Annual Inpatient Visits	Average Inpatient Days	Indirect Cost US$/Min
Boko Dispensary	Dar es Salaam	78,142,318	23,715	-	-	$0.02
Magomeni Health Centre	Dar es Salaam	1,346,071,496	80,835	11,023	2.4	$0.01
Mbagala District Hospital	Dar es Salaam	1,917,926,435	45,948	16,086	2.8	$0.01
Chipanga Health Centre	Dodoma	104,215,668	5,952	1,260	5.0	$0.005
Makole Health Centre	Dodoma	146,813,662	15,512	6,040	3.0	$0.002
Mvumi Mission Hospital	Dodoma	1,713,546,017	20,957	5,829	4.3	$0.02
Biharamulo District Hospital	Kagera	262,889,123	29,975	5,444	3.0	$0.005
Bunazi Health Centre	Kagera	119,664,320	17,519	3,386	3.0	$0.003
Igawilo Health Centre	Mbeya	369,031,860	35,102	729	2.5	$0.03
Inyala Health Centre	Mbeya	111,064,346	5,081	564	3.0	$0.02
Kiwanja Health Centre	Mbeya	242,090,164	34,967	788	1.0	$0.03

Facility Name	Region	Annual Operating Expenditure (TZS)	Annual Outpatient Visits	Annual Inpatient Visits	Average Inpatient Days	Indirect Cost US$/Min
Tukuyu District Hospital	Mbeya	284,699,145	36,483	7,898	5.0	$0.002
Luhanga Dispensary	Mwanza	81,430,000	8,955	-	-	$0.06
Mahaha Dispensary	Mwanza	36,429,827	3,247	67	3.2	$0.03
Misungwi District Hospital	Mwanza	1,287,234,514	19,983	3,104	4.0	$0.03
Ilembula Hospital	Njombe	1,820,908,500	20,047	6,686	2.7	$0.03
Lupembe Health Centre	Njombe	82,561,000	8,846	5,891	3.0	$0.001
Njombe Health Centre	Njombe	275,428,000	20,053	1,635	2.5	$0.02
Mwanzugi Dispensary	Tabora	53,258,000	5,797	-	-	$0.06
Mwisole Dispensary	Tabora	18,322,190	4,540	-	-	$0.03
Nzega District Hospital	Tabora	306,163,600	11,776	9,138	3.0	$0.003
Upuge Health Centre	Tabora	62,633,000	2,836	853	7.0	$0.003

Source: HP+ calculations

Table D4. Demographics of Clients Surveyed

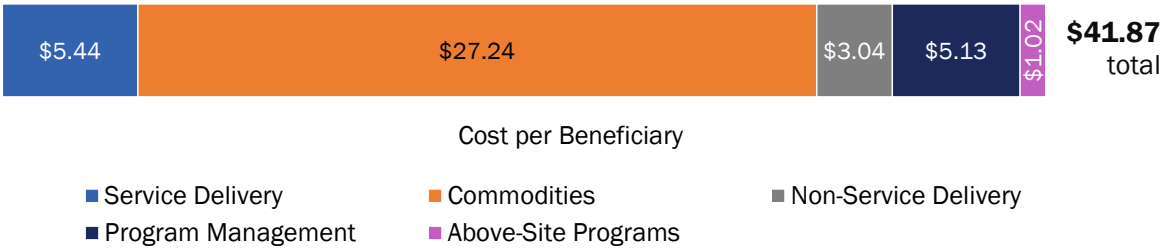
Characteristic	Type	#	%
Age	Average	39	–
	Median	35	–
	High	83	–
	Low	18	–
Household size	Average	5.5	–
	Median	4	–
Gender	Male	400	34%
	Female	791	66%
ART patients	New	111	17%
	Stable	281	43%
	Unstable	264	40%
Marital status	Married/in-union	580	49%
	Living together	78	7%
	Never married/single	224	19%
	Widowed	113	10%
	Divorced	177	15%

Characteristic	Type	#	%
Education	College/tertiary, completed	32	3%
	College/tertiary, didn't complete	7	1%
	Secondary, completed	106	9%
	Secondary, didn't complete	93	8%
	Primary, completed	583	50%
	Primary, didn't complete	141	12%
	No grade completed (none)	211	18%

Source: HP+ calculations

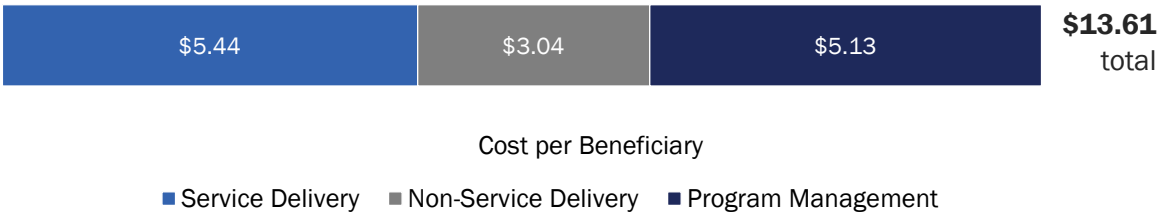
Annex E: Above-Site Level Results, Additional Figures

Figure E1. Cost per Person for Voluntary Medical Male Circumcision



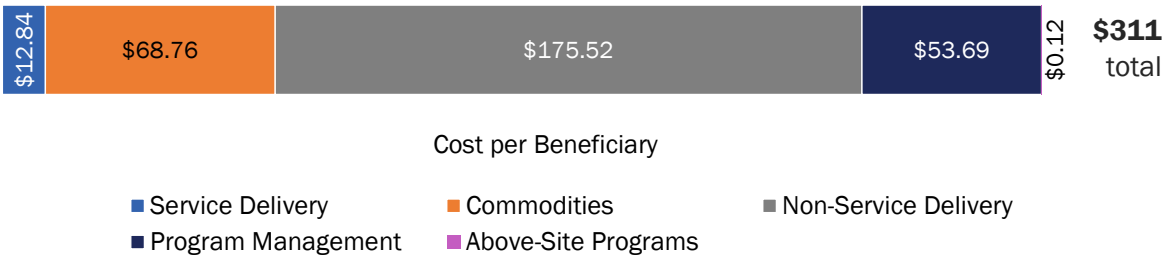
Source: PEPFAR, unpublished (2021); HP+ calculations

Figure E2. Cost per Person for Voluntary Medical Male Circumcision, Excluding Above-Site and Commodities



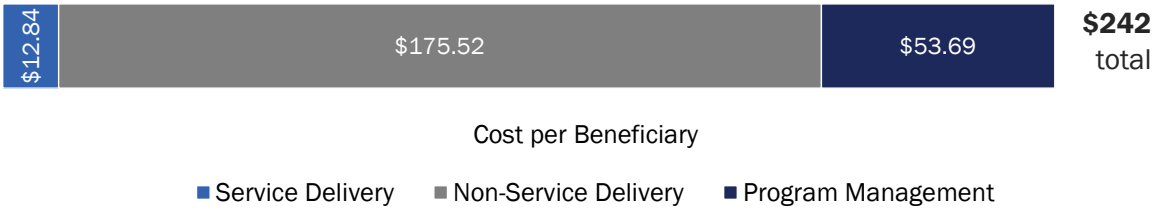
Source: PEPFAR, unpublished (2021); HP+ calculations

Figure E3. Cost per Person on Pre-exposure Prophylaxis



Source: PEPFAR, unpublished (2021); HP+ calculations

Figure E4. Cost per Person on Pre-exposure Prophylaxis, Excluding Above-Site and Commodities



Source: PEPFAR, unpublished (2021); HP+ calculations

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