COSTS AND OUTCOMES OF DELIVERING ANTIRETROVIRAL THERAPY (ART) IN THE PRIVATE AND PUBLIC SECTORS IN UGANDA

MONTHS 12-36 AFTER INITIATING ANTIRETROVIRAL THERAPY

FINAL REPORT

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FINAL REPORT

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EXECUTIVE SUMMARY

Uganda developed a pioneering program under which private clinics accredited by the Ministry of Health receive Government or donor funded antiretroviral drugs at no cost, provided that the clinics do not charge for these drugs. The clinics can charge for laboratory tests, consultations or other drugs. Employer based clinics and free standing private providers participate in this program, often receiving technical support from the USAID-funded HIPS (Health Initiatives for the Private Sector) project. This study builds on a previous study of patients during their first 12 months on ART at six selected public and private clinics accredited to provide ART. It analyses the outcomes and per patient costs at the same clinics in months 12 through 36 of antiretroviral therapy. We have estimated the savings to the Government and donors which occur when a patient receives antiretroviral therapy (ART) at the private clinics.

The study was conducted using a methodology developed by Rosen et al and previously applied to ART facilities in South Africa, Zambia and Kenya. Medical record data were obtained for a sample of patients completing 1-3 years of ART at three public clinics (100 patients per clinic) and three private clinics (50 patients per clinic). This data indicated all drugs dispensed (ARV and non-ARV) as well as lab tests received at these clinics from the 13th through the 36th month of ART. Unit costs were determined for each drug, test or service, and the fixed costs of the facility allocable to the ART program were added. Patient outcomes were determined from the medical record, at the end of 24 and 36 months from the start of ART, with patients in the sample classified as:

- no longer in treatment (died or lost to follow up),
- in treatment and not responding (as indicated by CD4 or viral load, or, in the absence of such tests, the presence of a WHO stage 3 or 4 AIDS-defining condition), or
- in treatment and responding.

Average treatment costs were determined for each outcome category at each of the six facilities. We calculated the value of the private resources leveraged when patients were treated at private clinics using the publicly supplied ARVs.

The majority of patients had a baseline CD4 count recorded, with the exception of one agricultural employer clinic, where patients were often initiated on ART based on clinical condition alone. Median baseline CD4 count ranged from 109 to 209 cells/mm^3. In our earlier study, patient outcomes in the first year of treatment were generally good. Between 77% and 88% of patients were in treatment and responding at the end of one year at four clinics. One public clinic had 97% in treatment and responding, and one private clinic 94%. In this new study, the proportion of patients who started the second year of treatment and finished the third, apparently responding to treatment, varied between 80% and 92%. The annual rate of "attrition" was lower than observed in the first year of treatment.

Treatment regimens were generally similar and consistent with national protocols. Some providers, generally those with higher costs, had a higher percentage of patients on regimens that included efavirenz, tenofovir, or lopinavir. Great variation was observed in the average number of lab tests per patient year. CD4 tests at all sites were relatively infrequent, with some providers ordering almost none, and all sites in this study ordered less than one per patient year. All clinics had between 10.5 and 13.5 patient visits per year in the first 12 months of ART, but this rate fell to 6.1 to 9.9 visits per patient year in months 12-24 after treatment initiation, and to 5.4 to 9 visits per year from months 24-36. Employer clinics often had higher visit frequencies than public clinics.

Over the second and third years of treatment, total cost per patient in treatment and responding varied from a low of $320 for two years of treatment at the rural public clinic to $686 at the private urban clinic. The other two public sites had per patient costs ($457, $402) similar to the two employer clinics ($470, $374) over the two year period.

The distribution of publicly sourced antiretroviral drugs in Uganda is saving public and donor funds. In the two employer clinics, private resources amounting to $53 and $137 per year are expended on the non-ART costs of caring for each patient from months 12 to 36 after treatment initiation. In two public facilities, annual expenditures on items other than ART were lower: $27 and $32 per patient-year in this treatment period. But at the third public site these costs were $105 per year. For the second and third years of ART, the private sector is contributing between 28% and 58% of the total cost of ART when it receives ARVs for free. If the patients were not being treated at these private clinics, the Government would need to expend a minimum of $27 to $32 per year to absorb each additional private patient into the public system.

1. INTRODUCTION

In Uganda, antiretroviral therapy (ART) is being delivered by providers in the public, nongovernmental, and private sectors. An innovative program exists to provide ARVs to accredited private sector providers that must then dispense these to their clients at no cost to their patients, but can collect regular fees for consultations, tests and other drugs. This has the potential to shift some patients to the private sector who would otherwise be forced to seek care in public facilities, and to harness some funds for AIDS treatment from employers, health insurance and patient resources. However, little was known about the relative costs of care in these different settings, or the differences, if any, in patient outcomes. In 2011, we reported on a study looking at patterns of care and costs in the first twelve months after starting ART at three public and three private clinics in Uganda. The study was sponsored by the USAID-funded Health Initiatives for the Private Sector (HIPS) project and conducted by HIPS personnel and the Boston University Center for Global Health and Development. The COAT (Costs and Outcomes of AIDS Treatment) model developed by Rosen and colleagues was used to collect and analyze patient records and facility costs. Data were abstracted for 150 patients starting ART at each public site and 50 patients at each private site.

The study found that the costs of care, including ARVs, were relatively comparable at two public clinics and two employer clinics; ranging from $239-$264 per year for each patient in treatment and responding at the end of twelve months. At one busy rural public clinic, where few lab tests were done, the cost per year for these patients was $202. At one urban private clinic, the comparable cost was $494 per patient per year. This clinic performed many more laboratory tests and had more patients on tenofovir (a more expensive first line antiretroviral) than the other clinics. The frequency of visits was very similar in public and private clinics, averaging once per month in this first year of treatment, and varying by site from a low of 10.6 to a high of 13.5 visits per patient per year. Treatment outcomes were relatively similar at the end of 12 months of ART. At the two urban public clinics, 77% and 78% of patients were in treatment and responding. Response was measured by CD4 count or viral load where available, and by clinical condition (including WHO Staging) in the absence of laboratory tests. At the public clinic where few laboratory tests were done, 97% of the subjects were in treatment and responding at the end of a year. In the two employer clinics, 88% and 94% of patients were in treatment and responding at twelve months, while at the urban private sector clinic 84% of those who started ART were in treatment and responding twelve months after starting ART.

Non-ART costs per patient year in the urban public clinics ($89, $93) were comparable to the two employer clinics ($99, 94). With outcomes similar, the report concluded that the provision of publicly funded ARV's to private clinics was a good investment, saving the Government or donors about $90 per year for each patient starting ART, while realizing similar patient outcomes. However, the report acknowledged that the reliability of outcome measures was limited, since such small proportions of public and private patients had a CD4 or viral load test at year end. Unless the remaining patients showed symptoms of an AIDS-defining illness, their first year treatment was deemed successful. A number of patients at the sites could have been failing treatment, but without the tests, the failure was not recognized. Policy makers and physicians who reviewed the report reasonably asked the question: Would the results be different if patients were followed into years two and three of ART, when treatment failure not diagnosed with laboratory tests would be revealed by the onset of AIDS defining conditions, or by subsequent laboratory tests?

To answer this question, and to determine how the pattern and costs of care change after the first year of ART, we conducted a second phase study at the same six clinics. Medical records of patients who completed at least one year on ART were retrospectively reviewed to determine outcomes and resource utilization during months 12 to 36 on antiretroviral therapy. Using data collection and analysis

techniques similar to those used in our earlier study, we present here the findings on costs and outcomes of the second and third year of treatment at the same public and private clinics.

The study was approved by, and conducted in accordance with the regulations of, the Boston University Medical Center Institutional Review Board, the Uganda National Council for Science and Technology, and the Ministry of Health of the Republic of Uganda.

A. Background and Rationale

Uganda was one of the first countries in Africa to develop a policy governing private sector provider access to Government purchased ARVs. The Ministry of Health promulgated accreditation guidelines for providers (public and private) that would be permitted to offer ART. Even before the expansion of public sector ART with funds from the Global Fund for AIDS, TB and Malaria (GFATM) and the US President's Emergency Plan for AIDS Relief (PEPFAR), ART was available to a small fraction of Ugandans who required it through a few NGOs, clinical research programs, and selected public institutions. A few wealthy Ugandans were able to obtain ART in the private sector at substantial expense. In 2004, Whyte and colleagues analyzed some of the social and political effects of this restricted and highly variable access to life saving therapy (1). A 2005 article summarized the experience of one major NGO facility in Kampala in providing treatment on a fee-for-service basis for 312 HIV positive patients with a median CD4 count of 79. The attrition rate was relatively high, but 35% remained alive and in treatment at 4 years (2). The article did not estimate the costs of treatment at the facility.

With large scale donor funding available from the GFATM and PEPFAR, Uganda ramped up its public sector ART program and began releasing ARVs to accredited private sector providers on the condition that such providers offer the drugs to their patients at no charge. USAID-supported projects -- Business PART and HIPS -- assisted private providers in the accreditation process, supplying technical assistance and supporting the necessary training for professional staff. In a preliminary evaluation, the Business PART project estimated the value of publicly provided ARVs and privately provided services at participating employer clinics. The public/private split of ongoing costs was about 50%/50%, so the cost to donors and the Ugandan government was less than it would have been if the patients were treated in the public system (3). However, this study did not compare unit costs in public and private facilities, nor did it measure patient outcomes. When assessing patient outcomes for ART we look at whether or not a patient is still in treatment, and if the patient is responding to the treatment. If ART is working, the patient is much more likely to be employed and to be meeting familial demands[1]. We also present the results of our costing by outcome category----all patients, those in treatment and responding at the end of a study period, those in treatment and not responding, and patients who died or were lost to follow up

Although cost estimates have been made for new interventions in Uganda (such as the innovative program for home delivery of ARVs), there is limited information available about the relative costs of the public and private models of treatment in standard use in Uganda, or the patient outcomes achieved by public and private treatment programs. Donor funds are unlikely to grow to the extent necessary to cover all the costs of ART care for all the patients who require it in Uganda, so private funding (and private care provision) may be necessary to treat all who need antiretroviral therapy. Our earlier study reported unit costs and outcomes for the first twelve months after initiating ART at six selected ART centers---three in the public sector and three in the private sector. In this study, we report on patient costs and outcomes for

[1] See articles by Rosen, Larson and colleagues from studies of patients entering ART in South Africa and Kenya. For example; Rosen S, Larson B, Brennan A, Long L, Fox M, Mongwenyana C, Ketlhapile M, Sanne I, "Economic Outcomes of Patients Receiving Antiretroviral Therapy for HIV/AIDS in South Africa Are Sustained Through Three Years on Treatment" PLoS One, 2010, Jan 5(9) e12731.

months 12 through 36 after initiation of ART. When reviewed in conjunction with our earlier report, we hope that this research will provide evidence for a decision on the continued provision of Government or donor purchased ARVs to accredited private clinics.

B. Objectives

This study uses a cost-outcome analysis, which is a variant of cost-effectiveness analysis, to estimate the costs of treatment at a facility level and to measure patient outcomes achieved. [Detailed information on CEA methods and recent review papers using these methods can be found in the Reference Section (4-8)].

The overall study objective is todetermine the average cost per outcome of providing ART in public and private sector facilities in Uganda for the period from 12 to 36 months after initiation of ART. The secondary objectives are to analyze who bears the cost of treatment at each site and to analyze any differences in costs or outcomes observed in the private versus public sector. To achieve these objectives, this study aims to answer the following research questions for each treatment delivery site selected:

1. What is the average cost per patient treated for resources used during months 12-24 and 24-36 following ART initiation at each public or private treatment delivery site?

2. What is the average cost per patient alive and responding to treatment at the end of each study period (ending 24 and 36 months after the initiation of ART) in each facility?

3. What is the breakdown of this average cost into major cost components (drugs, lab tests, professional labor, fixed facility costs, etc)?

4. For private sector facilities, what is the portion of the cost borne by Government or donors (value of ARVs provided) and what is the portion borne by the private sector (patients, insurers, or employers)?

2. METHODS

The study is a cost-outcome analysis using unlinked, retrospective medical record data to ascertain total resources used in the second year (months 12-24) and third year (months 24-36) after initiation on antiretroviral treatment. Patient outcomes are measured at months 24 and 36. Costs are measured from the perspective of the treatment facility for each treatment period (months 12-24, 24-36).The primary outcome is the average cost to produce a patient retained in care and responding to ART at months 24 and 36 after initiating therapy.

A. Site Selection

The study was conducted at a convenience sample of 6 treatment sites in Uganda, the same sites which participated in the earlier study of the first 12 months of ART. Each site was selected to serve as an example of a specific model, approach, or setting for delivering ART. Because the study was designed to identify, describe, and explain differences among models of treatment delivery (especially between the private and public sectors); sites were selected to capture variation in setting, scale, sector, and other facility characteristics. No effort was made to include a random or representative sample of sites.

At each public sector site, a consecutive sample of 100 adult patients who initiated ART no later than December 31, 2008 was enrolled. At most private sector sites in Uganda, enrollment is very slow with only 20-50 new patients started on treatment per year, even at the largest sites. As with the earlier study, we used a smaller sample of 50 patients at these private sites.

The study sites and their characteristics are presented in Table 1. The number of enrolled adult patients at December 2011 gives an idea of the relative size of the population being treated during the period studied. The public clinics at Jinja Referral Hospital and Kiswa Health Center in Kampala had the largest populations of patients on ART. The Kakira Sugar and Hima Cement clinics served employees and their dependents, and in the case of Hima, the clinic was open to some community members. The size of the population treated at these sites is therefore more limited.

The study sites and their characteristics are presented in Table 1.

Table 1: Study Sites

Site Name, Location	Sector & Characteristics	Scale (No of Adult ART Patients Dec 2010)	ART integrated with other services?	Supporting programs available at the site
Jinja Referral Hospital, Jinja	Public, periurban	1208	Yes	Community outreach, nutritional assistance
Katakwi Health Centre, Katakwi	Public, remote rural	497	No	Community outreach
Kiswa Health Centre, Kampala	Public, urban	3424	No	Nutritional support, community outreaches, basic care kits; Technical support from IDI
HIMA Cement, Kasese	Private, rural, large employer and also open to community(management of clinic is contracted out)	214	Yes	Nutritional support, Meals provided for staff; Also provides care to dependents and to nearby community members;
Kakira Sugar Company, Jinja	Private, periurban, large employer and also open to community	247	Yes	Palliative care, home visits, nutritional counseling, community outreach

Site Name, Location	Sector & Characteristics	Scale (No of Adult ART Patients Dec 2010)	ART integrated with other services?	Supporting programs available at the site
SAS Foundation, Kampala	Private, urban (some patients have health insurance)	339	Yes	Nutritional counseling, monthly outreaches, home visits, meals provided for staff

B. Sample Selection at Each Site

The study population is adult patients who are receiving care for HIV/AIDS from one of the six participating sites. Additional inclusion criteria include being 18 years or older at the time of ART initiation, initiated ART at the study site, still in care at the site 12 months after ART initiation, and did not (as shown in the medical record) transfer to another treatment site during the study period. It is possible that some subjects who were lost to follow up during the study period may have transferred to another clinic for ART.

At each site, the first step of sample selection was to review the site's roster of patients who had initiated treatment prior to December 2008. If not already sorted, the roster was organized by date of initiation. At each site we then enrolled patients sequentially beginning with those who initiated treatment on December 31, 2008 and working backwards until the sample was filled or census was complete. Patients who were found to be excluded were replaced with the next eligible patient.

Patients who did not initiate ART at the study site were excluded to ensure that we were costing all patients at the same stage of treatment, thus allowing better comparability across sites. In addition to searching in the patient file for evidence of prior treatment, we also checked baseline ARV regimens for each individual. The medical records of patients who had second-line drugs, such as Kaletra, as part of their baseline ARV regimen were queried to verify that the patient had not begun ART elsewhere.

C. Data Collection

MEDICAL RECORD DATA

Medical record data was extracted from paper records and entered in a CSPro database designed for the study. Data collection began with the twelfth month after each patient initiated ART up until 39 months post initiation or the last patient visit to the site, whichever came first. All visits to the clinic, professionals seen, drugs dispensed (both ARV and non-ARV), diagnostic tests conducted and other services received were recorded. Once all medical record data was extracted, one round of data cleaning was completed to verify any questionable data found. For each site we ran a set of standard queries which includes verifying appropriate ARV regimens at baseline and each subsequent visit; dates of initiation, death, and last visit; length of time between visits; ARV and non-ARV drug strengths and dosages; number of visits per patient and duplicate visits; in addition to verifying inclusion and exclusion criteria. Patient outcomes and resource utilization were then analyzed using SAS software, version 9.1.3 (Copyright, SAS Institute Inc., Cary, NC, USA[2]).

[2]SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc

UNIT COST DATA

A standardized cost data collection tool was designed for this study based on the data entry required for the COAT model. From each study site, we collected unit costs of drugs, diagnostic reagents, supplies and other variable inputs based on the most recent date of procurement and we recorded data from existing invoices. For all sites unit cost data was collected in mid 2012, with prices based on then current data. Information on the purchase, maintenance, and operating costs of infrastructure, equipment and other fixed costs was obtained from financial staff at each site or, if necessary, from data on relevant market prices (e.g. for donated furniture). Salary costs for each category of employee involved in the ART program were collected from payroll records, Ministry of Health reports, or site managers. Salary levels were collected by professional category and rank (e.g. "senior medical officer" or "enrolled nurse"), not individual. See Section D2 for further information on the costing of resources.

D. Data Analysis

The primary goal of this study is to estimate the average cost of resources used for treating patients, stratified by treatment outcomes.

PATIENT OUTCOMES

Each study subject was assigned a 24-month and a 36-month outcome on the basis of attendance, laboratory results, or condition at 24 and 36 months after initiating ART. To allow for variation in clinic visit and lab test schedules, information reported three months before or after the 24 and 36 month endpoints was used for assigning outcomes. The criteria for defining outcomes shown in Table 2 were based on prognostic indicators reported in the literature (11;12), clinical judgment, and on the definitions of treatment failure as defined in the Uganda National ARV Treatment Guidelines (13). Note that in this study, the purpose of assigning outcomes is solely to create categories of patients for whom average costs can be estimated. The study is not designed or powered to estimate, explain, or predict treatment outcomes as a primary result.

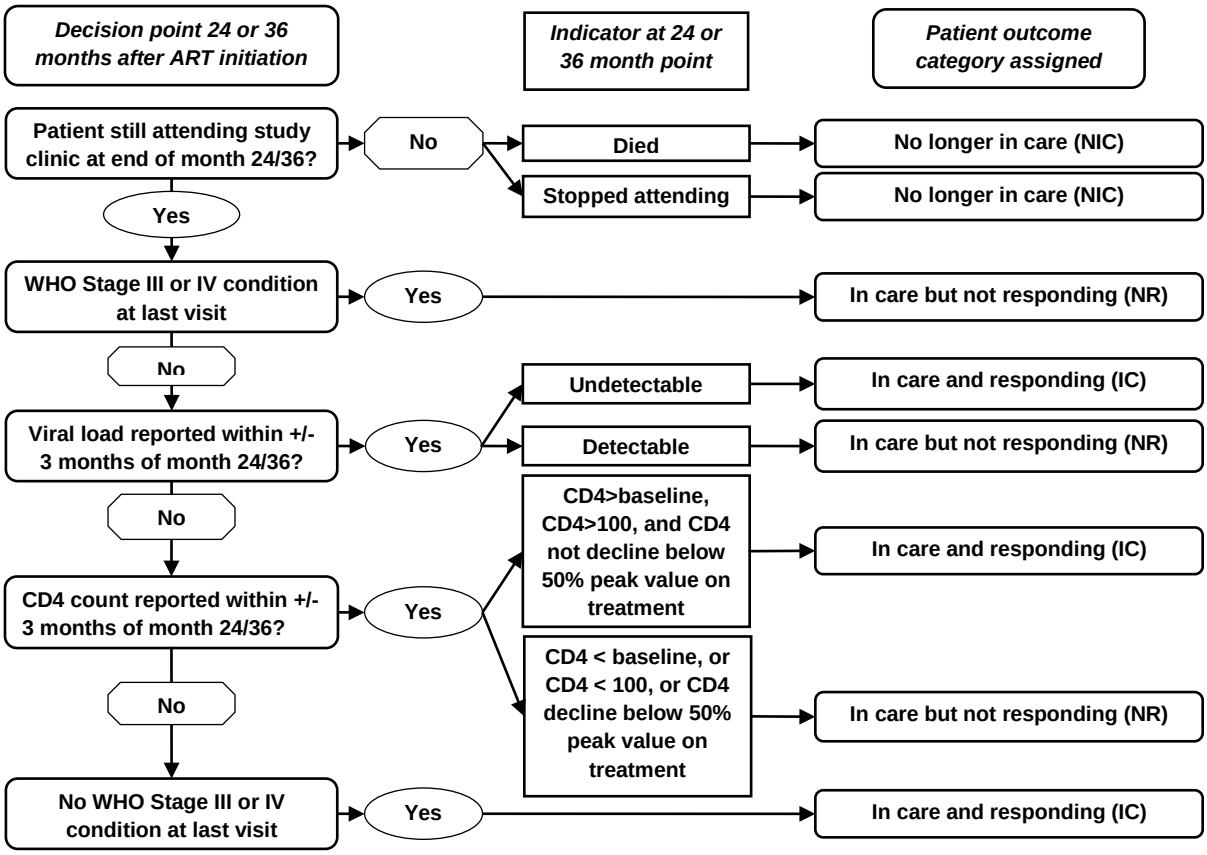
Table 2: Definitions of Patient Outcomes

Outcome	Criteria for Assigning Outcome	Definition of Criteria
Excluded from study	Transferred	Transferred to another treatment site before 36 months of treatment
	Never started ART	Never collected first month's supply of ARVs
No longer in care at site (NIC)	Died	Died in months 12-24, 24-36
	Stopped attending clinic (lost to follow up)	≥3 months late for last scheduled consultation or medication pickup before 24 and 36 months endpoint
In care but not responding (NR)	AIDS defining condition	WHO stage 3 or 4 condition at most recent visit closest to end of study periods (24, 36 months after treatment initiation)
	Detectable viral load	Viral load ≥ 400 at visit closest to end of study periods (24, 36 months)
	Unacceptable CD4 count	CD4 ≤ baseline, or CD4<100, or CD4 decline 50% or more from peak CD4 on treatment at visit closest to end of study periods (24, 36 months)
In care and responding (IC)	Undetectable viral load	Viral load ≤ 400
	Acceptable CD4 count	CD4 > baseline CD4, CD4 ≥ 100 and CD4 did not decline 50% or more from peak CD4 on treatment

Outcome	Criteria for Assigning Outcome	Definition of Criteria
	No AIDS defining condition	No current WHO stage 3 or 4 condition

Outcomes were assigned using the hierarchical decision process illustrated in Figure 1. Whether or not the patient is still attending the clinic is the first decision point. After that the study design prioritizes clinical condition over lab data to assign outcomes, so that patients who are clinically unwell (defined as a new or recurrent WHO Stage 3 or 4 condition) are assigned to the "In care but not responding" category even if their CD4 count has improved since beginning therapy. Viral load values are considered before CD4 counts to define outcomes. Finally, if a patient is still in care at the 24 and 36 month endpoints, does not have a new or recurrent Stage 3 or 4 condition at those times, and has had no viral loads or CD4 counts done in months 21-27 or 33-39 then they would be categorized as "In care and responding." This is important to note because at some sites where lab tests are infrequent, many patients may end up in the "In care and responding category" as long as they are still attending and have no AIDS-defining conditions.

Figure 1. Hierarchical Decision Process for Assigning Outcomes



COSTING OF RESOURCES

We used standard costing methods to estimate the resource utilization and costs of providing care for each study subject for the periods 12-24 and 24-36 months following ART initiation. Subjects who are not in

care at the study site at the end of the observation period do not incur costs for the entire period; for these subjects, fixed costs are pro-rated based on the number of months in care.

Costs included in the study are the costs for all resources that would hypothetically be needed for a provider to reproduce the study site and model, regardless of where the resources were obtained or who paid for them originally. Resources included and costing methods used are shown in Table 3.

Table 3: Methods for Estimating Costs

Type of Resource	Method for Estimating Unit Cost
Variable Resources	
Drugs, lab tests, medical supplies, etc.	Used actual costs to the site, based on invoices on record for the most recent procurement. Resources that were provided to the site by the government or a donor agency were included at the cost to the donor plus transport to the site. For drug costs, when no price was available at the site, costs were obtained from the Uganda Joint Medical Stores Price list. For any drugs whose price could not be obtained locally or were no longer in use, references such as the MSH Medicines Price list were used. For lab tests at the private sector sites, the standard price list for each site at the time of data collection was used as the cost per test. For two of the public sector sites, market values were obtained for the cost per test since many of the labs at each site are sent to other facilities for processing.
Outpatient visits	At each site, we took the total monthly cost for each type of provider visit (doctor, clinical officer, nurse, pharmacy, counseling) and multiplied it by the percent of time those professionals spent caring for ART clients. This cost for ART services was then divided by the number of patient visits to each type of provider to calculate a cost per encounter. The number of visits to each provider in a month was calculated by taking the total average number of ART visits to the site in a month and applying the ratios observed in our sample for each type of provider visit. For example, if 85% of patients in our sample saw a clinical officer on each visit and there were 500 ART visits in a month, then we set the number of clinical officer visits per month equal to 425. Professionals who do not have direct patient interaction, such as data entry personnel and administrative staff, are included as a fixed cost.
Fixed Resources	
Buildings (infrastructure)	If the actual rental or building cost was not available we took the estimated cost to rent (urban areas) or build (rural areas) comparable clinic space. We applied 2% depreciation to the purchase price of all facilities to calculate an annual cost to the ART clinic. Maintenance and operating costs were also included.
Vehicles, computers, other equipment	We took the purchase price if known or cost to purchase similar goods locally and added the monthly average costs for operations (petrol, lubricants) and maintenance (quarterly service, tyres, etc). All vehicles and furniture were depreciated assuming a useful life of 5 years for vehicles and 10 years for furniture. Electronic equipment and reusable medical supplies (such as pill counting trays or stethoscopes) were depreciated using a working life of 5 years. When visit data was available, fixed costs were allocated to the ART program using the ratio of ART patient visits to all visits in a month. When not available, estimates were obtained from site staff and information was triangulated to obtain the best estimate.
Administrative and other non-clinical (general) staff	Valued at total compensation rate as of mid-2012 at each study site. The percent effort that each staff member contributes to the ART program was calculated using the volume of ART visits or in some cases the ART workload. For example, at many sites the percent effort for the lab technician is more than the percent of visits made by ART patients as ART patients would often have more lab tests then other types of patients coming to the facility.
Office supplies, communications, and other regular monthly costs	Costs obtained from site invoices or comparable local market values if invoices unavailable.
Other fixed costs such as staff meals or monthly outreaches	Total costs of inputs used during outreaches, including additional petrol or supplies, obtained from financial records. Comparable local market prices were obtained if financial records unavailable.

Type of Resource	Method for Estimating Unit Cost
Excluded Resources	
Inpatient care or medical care provided by another facility	Medical care provided off site is rarely reported in patients' medical records and so cannot be costed. Inpatient admissions on site are also excluded since care provided in an inpatient setting was not linked to patient ART records at any of the study sites.
Costs to patients	Costs incurred by patients for items not obtained at the clinic (e.g. for transport) are not included in this analysis. However, the costs of service paid by patients, employers or insurers at private clinics are included in the clinic cost
Program management above the level of the site	For example, costs of technical assistance from a supporting organization (such as HIPS) or costs of developing and maintaining the ART program above the level of the site (at the district or national level) are not included in this facility-level costing.

Total fixed costs per patient-year at each site are calculated by summarizing all fixed costs for the site and dividing by the number of fully active patients at the site. To calculate the number of fully active patients we take the total number of adult and pediatric patients on ART plus an adjusted total number of patient-years for patients enrolled in pre-ART care. Pre-ART patients generally utilize fewer resources per year than a patient on ART for the entire year. A stable pre-ART patient may visit the site once every 6 months or a patient who is sick and newly enrolled in pre-ART care may make 2 visits in a month and then quickly begin ART. In either case, their resource utilization per patient-year is less than a patient on ART for the entire year. Each pre-ART patient therefore contributes less than 1 full patient-year to the denominator when calculating fixed costs per patient-year at each site. In this study pre-ART patients were assumed to make 2 visits to the site per year.

Once unit costs have been estimated for each resource input, they are multiplied by the number of units used by each subject during the study period, as extracted from the subject's medical record. Total costs per subject are then determined and summarized by cost category (ARVs, non-ARV drugs, lab tests, visits, support services, and fixed costs).

COST-OUTCOME ANALYSIS

Using the outcome, resource utilization, and cost data described above, we then estimated five cost/outcome ratios for each site and cohort, as defined by the COAT model and shown in Table 4. Costs were estimated for the one year period from 12-24 months after starting treatment and for the period from 24-36 months. Costs over the combined two year period were also estimated for all patients in the sample beginning at month 12 after initiating ART.

Table 4: Average Cost/Outcome Ratios to be Estimated

Ratio	Formula
Average cost per patient treated	$\frac{\text{All costs for all subjects in study}}{N = \text{all subjects in study}}$
Average cost per patient in care and responding (IC)	$\frac{\text{All costs for subjects in care and responding}}{N^{ic} = \text{only subjects in care and responding}}$
Average cost per patient in care but not responding (NR)	$\frac{\text{All costs of subjects in care but not responding}}{N^{nr} = \text{only subjects in care but not responding}}$
Average cost per patient no longer in care at study site (NIC)	$\frac{\text{All costs of subjects not in care}}{N^{nic} = \text{only subjects not in care}}$
Average cost to produce a patient in care and responding	$\frac{\text{All costs for all subjects in study}}{N^{ic} = \text{only subjects in care and responding}}$

The final ratio is the “production cost” and it incorporates the costs of patients who die, stop attending, or are non-responsive to therapy into an overall cost-effectiveness indicator for the site.

3. RESULTS

A. Baseline Patient Characteristics

Table 5 below shows baseline information for patients followed in this study. While data was collected for the 12-36 month period, baseline CD4 counts at Month 0 were also collected. These data are used to describe the cohort as well as to define patient outcomes at 24 and 36 months. Most patients had a baseline CD4 count at treatment initiation, except for one private site where patients were often initiated on ART based on clinical condition alone. The median baseline CD4 count for the six sites ranged from 109 to 209 cells/mm^3. Table 5 also shows the baseline percent of patients who are female at each site. Except at Kakira Sugar, where most workers are male, and at SAS Foundation, more than 60% of the patients were female.

Table 5. Patient Characteristics(Months 12-36 on ART)

	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
% Female	66%	64%	65%	58%	52%	52%
% with baseline CD4 count available	97%	100%	97%	98%	40%	98%
Median baseline CD4 count (at Month 0)	117	209	109	193	174	143

B. Patient Outcomes at 24 and 36Months

A total of 450 patients are included in this new analysis; 100 patients for each of the public sector sites and 50 patients for each of the private sites. For the earlier analysis, there were 150 patients at each of the public sites and 50 at the private sites. Table 6 shows the original study results, as well as results from this study indicating the percentage of patients in care at 12 months who were still in care and responding at 24 and 36 months. Also indicated is the proportion patients who were in treatment but not responding, as well as those who died or dropped out of treatment at the 24 and 36 month milestones.

There is no clear trend or difference in outcomes between the public and private sector sites. Each sector had one site with remarkably low attrition in the earlier study (3% at Katakwi and 2% at Kakira). The excellent outcome at Katakwi was attributed to the fact that it is the only ART site in the district and had fewer ARV stock outs than some other sites.

Table 6. Patient Outcomesat Key Milestones (as a % of subjects studied)

	Public Sector Sites			Private Sector Sites		
Outcome	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
In care and responding						
Original study (12 months)	*77%*	*97%*	*78%*	*88%*	*94%*	*84%*
At 24 months	90%	98%	93%	96%	88%	88%
At 36 months	84%	83%	92%	92%	88%	80%
In care and not responding						
Original study (12 months)	*10%*	*1%*	*12%*	*8%*	*4%*	*8%*
At 24 months	1%	1%	4%	0%	2%	2%
At 36 months	2%	1%	0%	0%	0%	0%
Died						

Original study (12 months)	*5%*	*2%*	*4%*	*2%*	*0%*	*2%*
At 24 months	3%	1%	2%	0%	0%	0%
At 36 months	3%	2%	3%	2%	0%	0%
Stopped Attending						
Original study (12 months)	*8%*	*1%*	*6%*	*2%*	*2%*	*6%*
At 24 months	6%	0%	1%	4%	10%	10%
At 36 months	11%	14%	5%	6%	12%	20%

For every clinic studied, 80% or more of patients who reached the twelfth month of ART were alive and successfully in treatment at the end of three years. For two high volume public clinics (Jinja, Kiswa) and one private clinic (Hima), patient losses over two years (12-36 months) were less than they had been in the first year of treatment. Recorded deaths between 12 and 36 months of treatment were never more than 3% of the patients studied, and generally the same or less than in the first twelve months of treatment. Except at Hima Cement (an isolated location with a desirable employer) and Kiswa public clinic, between 12% and 20% of the patients who were in treatment 12 months after starting ART were lost by the 36th month. The private clinic in Kampala (SAS) had the greatest loss to follow up, however some of these patients may have transitioned to a public program or another private provider. If the site knew the patient had transferred, that person was excluded from this study. But if the site did not know, then we had no basis to exclude them from this study, and they would be assigned an outcome of lost to follow up.

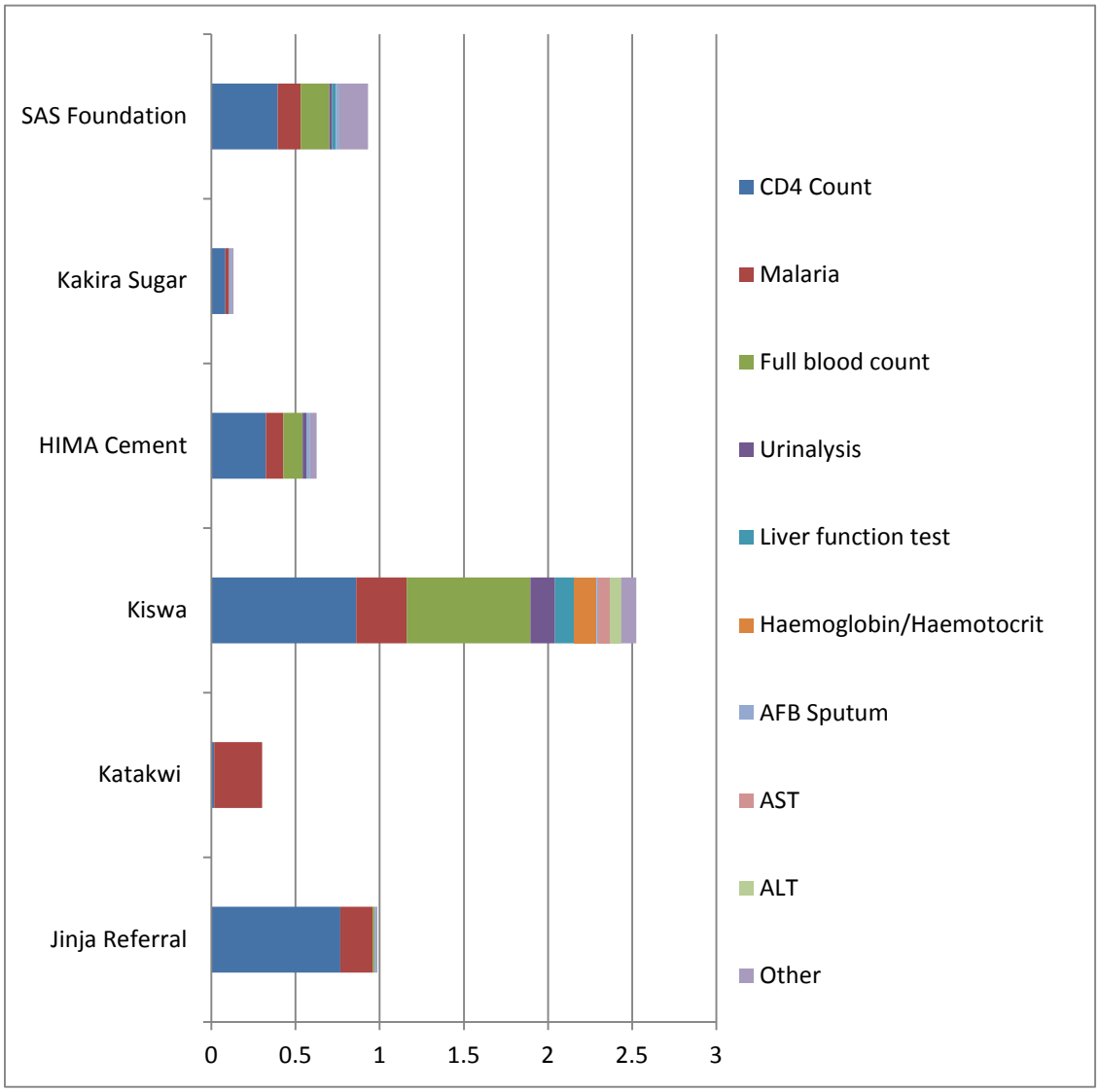
Successful retention at 24 months was again highest at the rural public clinic, Katakwi. However, by the end of the third year of treatment, successful retention was down to 83% of those who were in treatment 12 months after starting ART.

In our earlier study, we hypothesized that outcomes might look better at some clinics that did fewer tests (Katakwi, Kakira) because laboratory-based evidence of treatment failure was not available, and clinical signs of failure had yet to appear. Although recorded deaths at these sites did not rise dramatically from months 12 to 36, the proportion of patients lost to follow up by the third year was substantial (14% Katakwi, 12% Kakira). The loss to follow up rates could include unrecorded deaths, which would indicate that treatment was failing at the end of the first year but not detected due to the lack of tests.

C. Resources Used to Achieve Outcomes

Before looking at the total costs per outcome, it is useful to see what types of variable resources were used to provide care for these individuals, namely the specific ARV regimens in use at each site and the types of diagnostic tests ordered. The choice of resources and frequency with which they are used will form the basis for understanding differences in costs seen among the study sites. Figure 2 shows the total number of diagnostic tests per patient-year in care from months 12-36 of ART at each site. The specific type of test is also shown. Names of lab tests are listed in the legend from most to least frequently ordered, using the total number of each type of test for all sites combined to determine the frequency.

Figure 2.Number of Diagnostic Tests Conducted per Patient-Year



The most frequent tests in years two and three of ART are now run at the Kiswa public clinic in Kampala, which is managed with the assistance of the Infectious Disease Institute. Tests are relatively infrequent at Katakwi rural public clinic and the Kakira Sugar Works. In the first year of treatment, SAS Foundation had the most laboratory tests per patient, but this has declined significantly---perhaps because physicians are confident that patients are stable and adherent, or perhaps because patients in treatment longer are unable or unwilling to pay for so many lab tests.

CD4 tests are the most frequent test conducted. Jinja and Kiswa do between 0.5 and 1.0 CD4 test per patient year for these longer term patients. At SAS and Hima, frequency of CD4 tests ran between 0.3 and 0.4 per patient year. Kakira did few CD4 tests, and Katakwi almost none. Overall, malaria tests were the second most common laboratory procedure. Full blood counts were relatively frequent at Kiswa, but not at any of the other sites. Viral loads did not show at any of the sites. Only at Kiswa did we observe an average of more than one test of any kind per patient year. It appears that these patients are viewed as relatively stable by their physicians, and the utilization of laboratory tests is substantially lower than was observed in the first twelve months of treatment.

Table 7 shows the distribution of patient months on treatment by regimen between months 12 and 36 of treatment. AZT-3TC-NVP was the dominant mode of treatment at Jinja, Katakwi, and Hima. Kiswa was more dependent on an efavirenz based regimen (45% vs 47% for AZT-3TC-NVP). SAS, which had initiated the largest percentage of patients on tenofovir in the first 12 months of treatment in the last study, showed the greatest use of tenofovir and the only use of lopinavir in these longer term patients.

Table 7. Percent of Patient-months Spent on each Drug Regimen (12-36 Months of Treatment)

Drug Regimen	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
AZT-3TC-NVP	54%	80%	47%	81%	42%	37%
AZT-3TC-EFV	5%	2%	45%	3%	3%	17%
D4T-3TC-NVP	18%	10%	-	8%	47%	7%
TDF-FTC-EFV	1%	-	-	-	-	9%
TDF-FTC-NVP	1%	-	-	-	-	0%
LPV/r with AZT *or* TDF	2%	1%	-	-	-	1%
Percent of patient-months with no ARVs given	-	-	-	-	-	3%

Of significant interest is the percentage of patients who received no ARVs for some portion of the treatment period under study. This was as high as 20% at Jinja and 26% at SAS. In comparison, in the first year of ART, this percentage was never more than 5.1% at any provider. This phenomenon could have occurred because drugs were unavailable. Or the patient may have failed to return for a refill at some point during the study period, but was still obtaining care at the clinic at the end of the period. Two public clinics—Katakwi and Kiswa—and the two employer clinics—Hima and Kakira—had low percentages of failed refills (8% to 9%). Although the ARVs were free at SAS, the charges for other services may have deterred some patients from returning at some point during the study period. At the public and employer clinics, there would be essentially no service charges.

The frequency of visits fell as patients remained in treatment for longer periods of time. Table 8 shows the annual visit frequency at each site for each period of ART care (1-12, 12-24 and 24-36 months of care). In the first year, patients at all sites average almost one visit per year, with more than 10 visits per year at every site. Between 12 and 24 months of treatment, visit frequency fell at every site, with Katakwi and SAS falling to an average of little more than a visit every other month. Visit frequency fell further in year three at every provider except Kakira Sugar, where it rose from 7 to 8 visits per year. At SAS and Katakwi, average visit frequency was less than once every other month in the third year of treatment.

Table 8. Visits per Patient Year

	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
Months 1-12 on ART (Original study)	10.5	13.1	10.6	11.6	12.4	13.5
Months 12-24 on ART	8.4	6.1	8.4	9.9	7.0	6.4
Months 24-36 on ART	7.0	5.4	7.6	9.0	8.0	5.7

That lower visit frequencies correlate with longer time in treatment is not surprising. Providers may give more than a 30 day supply of ARVs to patients who have been on treatment longer and are stable. Overall, this decline in visit frequency is likely an indicator of stable treatment, with the annual attrition rate lower in the second and third years of treatment than it was in the first.

D. Average Cost per Outcome

Once all the resource utilization and outcomes have been analyzed for each patient and the unit costs determined, the total cost per patient, by outcome, can be summarized and then broken down into the major cost components which are driving the total cost. Tables 9a-9c present the average cost per patient and per outcome in Ugandan Shillings (UGX) and United States Dollars (USD). We have divided the tables by outcome, and include the results from the original study (months 1-12 of ART) and from the two one year periods after 12 months on ART. US dollars are shown in parentheses.

For the earlier study, an exchange rate of 2,232 Ugandan shillings / $1 USD, the average between July and December 2010, was used. Cost data was collected in early 2011 using cost records from the second half of 2010. For this study (months 12-36 of ART) cost data was collected in the first half of 2012 using costs at the end of 2011 and the average exchange rate of 2,663 Ug shillings to the US$ between July and December 2011(per OANDA.com) is used.

Table 9a. Average Cost per Patient, All Patients in Care by Start of Period, UGX and USD

	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
Months 1-12	517,077 ($232)	443,801 ($199)	558,368 ($250)	579,654 ($260)	525,394 ($235)	1,057,022 ($473)
Months 12-24	550,955 ($209)	419,882 ($159)	521,543 ($198)	490,475 ($186)	575,360 ($219)	915,495 ($348)
Months 24-36	627,254 ($238)	390,667 ($148)	507,580 ($193)	483,683 ($184)	641,999 ($244)	783,651 ($298)

Table 10b. Average Cost per Patient, All Patients Alive and in Care at End of the Period, UGX and USD

	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
Months 1-12	548,111 ($245)	451,934 ($202)	572,067 ($256)	588,574 ($264)	531,462 ($238)	1,100,111 ($493)
Months 12-24	573,866 ($218)	421,942 ($160)	532,051 ($202)	495,829 ($188)	607,221 ($231)	962,022 ($365)
Months 24-36	645,923 ($245)	417,873 ($159)	525,137 ($199)	491,490 ($187)	676,443 ($257)	841,685 ($320)

Table 11c. Average Cost per Patient, No Longer in Care at End of the Period, UGX and USD

	Jinja Referral	Katakwi	Kiswa	HIMA Cement	Kakira Sugar	SAS Foundation
Months 1-12	315,353 ($141)	146,941 ($66)	435,077 ($195)	365,567 ($164)	228,034 ($102)	572,271 ($256)
Months 12-24	319,293	215,985	181,772	361,993	288,612	496,745

	($121)	($82)	($69)	($137)	($110)	($189)
Months 24-36	306,148 ($116)	200,226 ($76)	103,751 ($39)	304,116 ($115)	263,114 ($100)	319,382 ($121)

The differentials in cost per patient between providers are generally similar to what was observed in the first year of antiretroviral therapy. SAS continues to have the highest costs per patient year of treatment and Katakwi remains the lowest. Katakwi is a high volume clinic where few laboratory tests are done, while SAS does more lab tests and uses more physician time. In the earlier study, Kakira Sugar had lower per patient costs than the other employer clinic, Hima Cement, but in years two and three of ART, Kakira's costs are higher than Hima for all patients, and for those patients who remain in treatment at the end of years two and three.

Costs per patient year, averaged over all patients, fall at all providers from year one to year two. For four of the six providers, such costs fall further in the third year of treatment. Only at Kakira and Jinja, do the costs rise in year three, exceeding the per-patient costs from both the first and second years of treatment.

If we look only at patients still in treatment at the end of a year (Table 9b), we again see a general downward trend from year one to year two of treatment, except at Kakira. In the third year, the costs for patients remaining in treatment go up slightly at Jinja and Kakira, while the costs plateau at Katakwi, Kiswa and Hima and continuing to decline at SAS. For the relatively small number of patients who are lost to care in a year, there is no consistent trend in the unit costs, which are highly sensitive to when the patient drops out and to medical complications which arise.

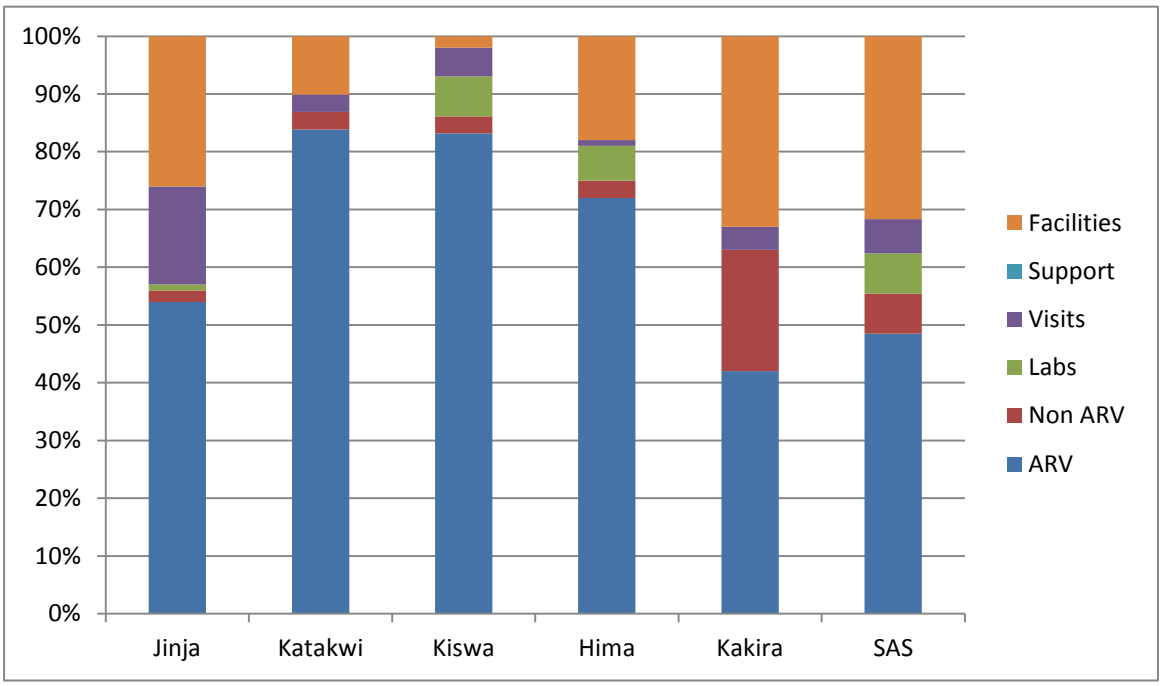
The general conclusion is that costs per patient year will generally, although not universally, be lower once patients have been on ART for more than a year. When combined with the lower annual rates of death and loss to follow up observed earlier, it is reasonable to assume that the cost per year of life prolonged will be lower after the first year of treatment, at least through 36 months from the date of treatment initiation.

We look next at the total cost for two years (12-36 months of treatment) for those patients still in care at 36 months. These are shown in Table 10. The distribution of the various cost elements within these totals is shown in Figure 3. Uganda shillings are converted to the US $ at the rate (2633) prevailing in March 2012.

Table 12.Costs and Outcomes, Months 12-36 of ART

	% of Patients in Care at Month 36	Total Cost (Ug Shillings) Per Patient in Care at Month 36	Total Cost (US $) Per Patient in Care at Month 36
Jinja Referral	86%	1,202,886	$457
Katakwi	84%	842,477	$320
Kiswa	92%	1,057,430	$402
HIMA Cement	92%	984,934	$374
Kakira Sugar	88%	1,236,684	$470
SAS Foundation	80%	1,807,199	$686

Figure 3.Distribution of Cost Elements, per Patient Costs Months 12-36 Inclusive

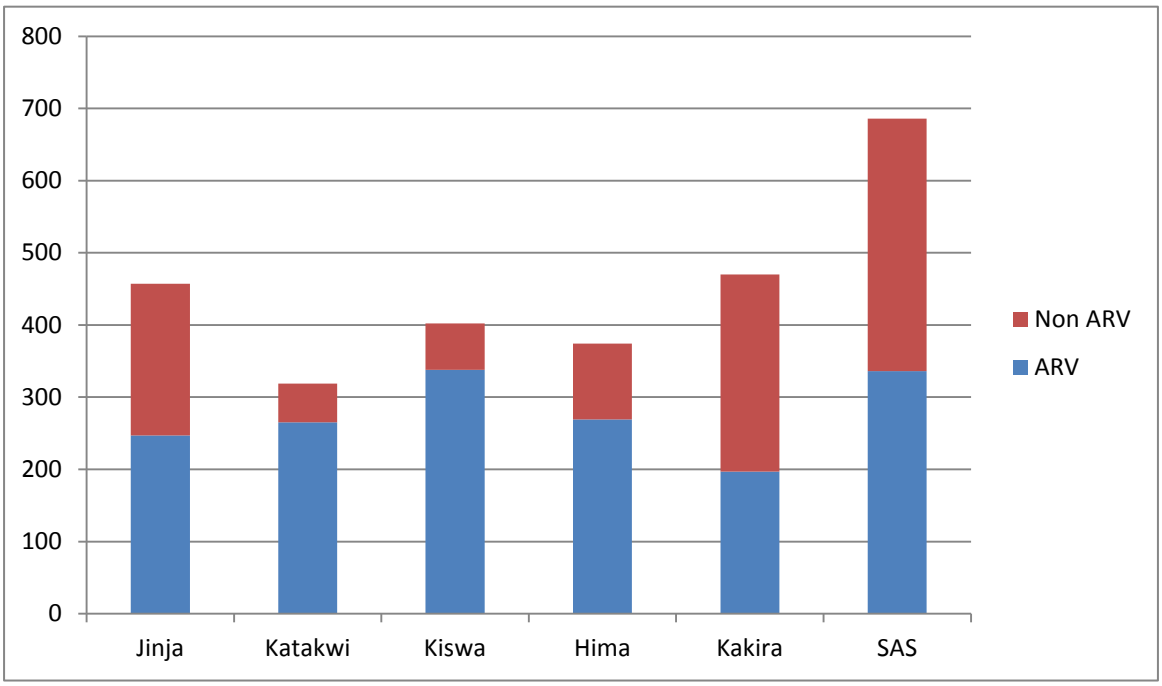


The cost of the ARV drugs themselves accounts for more than 50% of total cost at the three public clinics and Hima, rising to over 80% of costs at Katakwi and Kiswa. ARVs were only 42% of total costs at Kakira, but here 21% of costs went for non-ARV drugs, perhaps reflecting a higher prevalence of malaria in the patient population.

Laboratory costs were a significant portion of the total only at Kiswa, Hima and SAS, all of which showed a higher frequency of lab tests. Visit costs reached 5% or more of the total only at the Jinja Referral and Kiswa clinics, and at Kakira, which in the earlier study tended to use physicians rather than nurses or clinical officers for patient encounters. Facility costs were 18% or more of the total, except at Katakwi and Kiswa clinics, which may reflect some discrepancies in facility costing, or a very high rate of utilization for the available space.

Compared to the first twelve months of ART in our earlier study, the antiretroviral drugs are a larger proportion of the total costs of care. In that study, ARVs varied from 47% of total costs at SAS to 80% at Katakwi, but ran 61% to 63% at all other sites. The higher percentages spent on ARVs in this study is consistent with a more stable patient population after twelve months of care, making fewer visits and receiving fewer lab tests each year. Figure 4 summarizes ART and non-ART costs. In all clinics, the Government or donors provide the ARVs; in the private clinics, the employer, insurer or patient is paying for the other aspects of cost. In effect, the ART costs at private clinics are the "public" share or subsidy for the total costs of care.

Figure 4. ARV and non-ARV Costs, per Patient, for Care in Months 12-36 of ART (USD)



ARV costs per patient in the study were highest at Kiswa Clinic ($338 for two years) and at SAS ($336 for two years. These are the clinics that had the highest use of efavirenz, which is more costly than older first line drugs. SAS also used more tenofovir, now a preferred first line drug, but also more expensive than the first line drug it replaced. ARV costs per patient at the other public clinics (Jinja and Katakwi) and at Hima were comparable, running $247 to $269 in the two year period. Kakira sugar had the lowest ARV costs, but the highest cost for other drugs (which the employer purchased).

Non-ARV costs per patient were lowest at the two busy public clinics, Katakwi and Kiswa. As in the previous study, such costs were highest at the SAS clinic. The Hima employer clinic spent $105 per patient over months 12-36 of treatment, but Kakira (with its higher non-ARV drugs costs) spent $273 per patient, an amount $76 in excess of what it received from the public sector in the form of ARVs.

E. Who Bears the Cost of Treatment?

Does the public sector save money as a result of subsidizing the private sector with publicly procured ARVs? Table 11 gives the answer. The privately funded resources are 28% to 58% of the total cost of care at the private facilities. At a minimum, costs incurred by public facilities for items other than ARVs during months 12-36 of treatment are $54 (Katakwi) to $64 (Kiswa). At Jinja Referral, the Government incurs non-ARV costs for the second and third year of ART ($210) that are double those at the Hima clinic ($105). Even in the busy public clinics, Government incurs costs of $54 to $64 for the second and third year care of ART patients under existing protocols. Thus, Government is "leveraging" at least this amount in private sector resources by supporting the treatment of ART patients in private clinics through the accreditation program and the distribution of free ARVs to accredited clinics.

Table 13. Public Sector Savings due to Provision of ART in the Private Sector

Costs per IC patient	Jinja Referral	Katakwi	Kiswa	Hima Cement	Kakira Sugar	SAS Foundation
ARVs	$247	$265	$338	$269	$197	$336

All other costs	$210	$54	$64	$105	$273	$350
Total	$457	$320	$402	$374	$470	$686
% of total cost borne by the private sector				28%	58%	51%

4. DISCUSSION

A. Comparison of Outcomes in the Public and Private Sectors

After 36 months of treatment, Kiswa public clinic and Hima private clinic had the best outcomes of any of the clinics studied. 92% of their patients who had been on ART for twelve months were in treatment and responding at 36 months. Kakira Sugar was next at 88%, followed by the two other public clinics Jinja (84%) and Katakwi (83%). SAS trailed, with only 80% of the patients who were in treatment at 12 months still in treatment and responding at 36 months. In short, there is no evidence in this study that public clinic operation per se results in better outcomes. Katakwi public clinic, which had the best performance in the first 12 months of ART (97% of patients in treatment and responding at month 12), slipped relatively more than other clinics. This suggests that the lack of tests noted at Katakwi may have obscured some treatment failures in year one which became evident over the succeeding two years.

Overall, the annual attrition rates in years two and three of ART were lower than in year one. Over the two years from months 12-36 of ART, Jinja, Kiswa and Hima had a smaller percentage of patients die, drop out or fail treatment than in the first twelve months of treatment. Kakira Sugar had a slightly higher "loss" rate from 12 to 36 months of treatment (12%) than in the first 12 months (6%), but the annual loss averaged out the same. Overall, the annual rates of loss (patients dying, dropping out or not responding to treatment) were less at 36 months than in the first twelve months of treatment.

B. Comparison of Costs in the Public and Private Sectors

By providing ARVs at an average annual cost of $99 to $168 to patients in their second and third years of ART, the Government and donors leverage private resources worth $53 to $175 per year from the private sector in the accredited private clinics where these patients were treated. For patients in the second and third years of ART, it would cost the Government a minimum of $27 to $32 per patient year to cover the non-ARV costs if these patients sought care in the more efficient public clinics studied (Katakwi and Kiswa). If the patient went to Jinja Hospital, which had the highest cost of the public facilities studied, the Government would incur $105 per year in non-ART costs. As measured by the percentage of patients remaining in care and responding, there is no consistent quality advantage to the public sector clinics. In particular, employer clinics like Hima and Kakira, which have ongoing relationships with employees and their dependents, appear to be particularly effective in retaining and treating these longer term patients.

C. Limitations of the Study

Because of its limited nature, the study cannot be representative of all public or private treatment sites in Uganda. We selected sites where we had a reasonable expectation of being able to collect quality patient data, and private sites that had an established working relationship with the HIPS project. These were the same sites that had already participated in our earlier study of the first 12 months of ART.

With existing protocols, antiretroviral treatment must continue for life. We have now measured costs and outcomes for the first 36 months of care, but results may differ—both in costs and outcome—as patients remain on the drugs even longer. So these costs may not be indicative of average costs when patients are on treatment for several more years. The sites we studied did not generally do CD4 tests every year, and some did very few. We recorded almost no viral load tests. Our results therefore may indicate that some patients are in treatment and responding when they have actually begun to fail treatment, but this not yet been detected. The treatment outcome rates we report may overstate the success of the programs studied for this reason. On the other hand, some of the patients lost to treatment may have continued treatment at another site. We expect this is particularly true at the high cost private clinic in Kampala (SAS). Thus,

our results may understate the success of ART for patients who were categorized as loss to follow up by our study but may, in fact, still be receiving treatment elsewhere.

5. CONCLUSIONS

We have confirmed the primary result from our earlier study of the first 12 months of ART. The provision of ARVs from Government and donor stocks to accredited private providers results in ART reaching additional patients without increasing the rolls at Government treatment sites. For patients in the second and third year of ART, employer clinics continue to incur the non-ARV costs of treating patients, spending $53 (Hima) and $137 (Kakira) per year for the necessary staff, tests, facilities and non-ARV drugs. Expenditures for the same items at the most expensive public site (Jinja Hospital, $105 per year) are in the same range. Lower cost public clinics have annual non-ARV expenditures for this population of $27 to $32 per year. The Government saves at least this much every year for each patient treated in a private clinic from months 12 to 36 after initiating ART. The treatment outcomes are similar, as measured by the percentage of patients alive and responding to treatment at the end of 36 months on ART. In fact, these outcomes are better in the two employer clinics than at two of the three public clinics, although the differences are not necessarily significant.

Some have attacked the Uganda program that distributes ARVs to accredited private providers as an unwarranted subsidy of the private sector, particularly when the national program as a whole is still falling short of ART targets. But this is short sighted. Employers, like Hima and Kakira, are not obligated to provide their workers (or dependents and the community) with ART. The employers could elect to send these patients to public clinics. This would increase the treatment backlog at public clinics. Yes, the employer is getting a benefit—effective treatment of HIV positive workers, with less worker attrition and time lost to queue in public clinics. But the public sector experiences a saving of at least 16% to 17% of the annual cost for every ART patient in treatment at a private site in years two and three. These savings are lower than we found in the first year of ART, but costs per year of treatment were generally lower after the first 12 months, with ARVs constituting a larger percentage of total costs at four of the six sites.

ARVs are a product that donors working in multiple countries are well positioned to obtain at low prices through bulk purchase. Publicly funded ARVs provided to accredited clinics in Uganda leverage private resources to care for a portion of HIV positive patients. Because of the public sector price advantage, the flow of publicly funded ARVs also lowers the overall societal cost of treating AIDS patients, even if private sector funds could be found to replace Government provided ARVs. Providing publicly funded ARVs to accredited private clinics, particularly employer clinics, saves money for the Government and donors, yet achieves similar patient outcomes.

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