USAID | RWANDA
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RWANDA HIV/PBF PROJECT:

Cost and Revenue Analysis in Six Rwandan Health Centers: 2005 costs and revenues

CONTRACT NO. GHS-I-00-03-00030-00,
TASK ORDER NO. GHS-I-02-03-00030-00

This publication was produced for review by the United States Agency for International Development. It was prepared by Management Sciences for Health.

Submitted by:

Management Sciences for Health

Rwanda HIV Performance-Based Financing Project

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20 December 2007

Contract No. GHS-1-00-03-00030-00,
Task Order No. GHS-I-02-03-00030-00

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LIST OF ACRONYMS

AF	Annuity Factor
AGRI	Agricultural Sector Insurance Program in Rwanda
AIDS	Acquired Immunodeficiency Syndrome
AFC	Average Fixed Cost
ANC	Antenatal consultation
ARV	Antiretroviral Drugs
ART	Antiretroviral Therapy
ATC	Average Total Cost
AVC	Average Variable Cost
CORE	Cost and Revenue Analysis, an MSH tool
CORE-Plus	Cost and Revenue Analysis Plus, adapted from the CORE tool
CORE-Plus R	As above, CORE-Plus adapted for use in Rwanda
CS	Centre de Sante (health center)
CRS	Catholic Relief Services
EGPAF	Elizabeth Glaser Pediatric Aids Foundation
FARG	Fonds National pour l'Assistance aux Rescapés du Génocide/Victims of Genocide Fund
FBO	Faith Based Organization
FHI	Family Health International
FRW	Franc Rwandaise (Rwandese Franc Currency)
GDP	Gross Domestic Product
GESIS	Rwandan National Health Information System
GOR	Government of Rwanda
HR	Human Resources
HIS	Health Information System
HIV/VIH	Human Immunodeficiency Virus
ICAP/MCAP	Multicountry Antiretroviral Program in Africa, Columbia University Mailman School of Public Health
IHI	IntraHealth International Inc.
OI	Opportunistic Infection
MAP	Multicountry AIDS Program [WB]
MC	Marginal Cost
MOH	Ministry of Health
MSH	Management Sciences for Health
PBC	Performance-based Contracting
PBF	Performance-based Financing
PEPFAR	President's Emergency Plan for AIDS Relief
PMA	Paquet Minimum des Activités: Basic package of health services
PMTCT	Prevention of Mother-to-Child Transmission [of HIV]
PNC	Postnatal consultation
QA	Quality Assurance
RAMA	La Rwandaise d'Assurance Maladie
RFA	Request for Applications
SD	Standard Deviation
SIS	Système d'Information Sanitaire (Health Information System)

SPW	Service Practice Worksheet (CORE)
TC	Total Cost
TRAC	Rwandan Treatment and Research AIDS Center
TFC	Total Fixed Cost
TVC	Total Variable Cost
TWUBAKENE	A project of IntraHealth International and partners in Rwanda
USD	United States Dollar
USG	United States Government
VCT	Voluntary Counseling and Testing
WB	World Bank

ACKNOWLEDGMENTS

The authors of this report would like to thank the many individuals and organizations that provided information crucial to the completion of this study. Providing their time, energy and patience were the staff of the six health centers studied. We also thank Thaddée Kibamba, the Director of Health for Gicumbi district, and Dr Diocles Mukama Twagiramungu Director of Byumba Hospital for their active support during the field visits. Utilization data was provided by Rigobert Mpendwanzi and Emilien Nkuzi from the MOH, by Bosco Migernanshiro from Byumba Hospital, by Elvanie Umunyana from TRAC and Jean Gatana from IntraHealth International. Donor subsidy data was provided by IntraHealth International and the Global Fund.

Additionally, the authors would like to thank for their efforts in completing the Standard Practice Worksheets, Drs Ousmane Faye and Kathy Kantengwa from the MSH HIV PBF project, Dr Apolline Uwayitu from the quality assurance project, Drs Jeroen van t' Pad Bosch, Odette Mukandanga and Florentine Musabyimana from EGPAF, Dr Gerard Ngendahimana, Jean Gatana and Edith Musabyimana from IHI and Dr Fabienne Shumbusho from FHI. The Byumba Hospital team is gratefully acknowledged for participating in the 4, 5 and 6 May 2006 Standard Treatment Practice Workshop in Kigali.

Special thanks are also extended to Sidonie Uwimpuhwe of the Integration-Decentralization Taskforce and MSH-Rwanda staff members Ismael Amri Sued, Christine Mukantwali and Aimee Senzeyi, who patiently helped with data collection. MSH-Cambridge staff, David Collins and Elizabeth Lewis, provided crucial guidance in the development of this cost and revenue data analysis.

Finally, we would like to thank USAID-Rwanda for their on-going support of this study.

EXCECUTIVE SUMMARY

Management Sciences for Health has been awarded a contract by USAID through PEPFAR funding, Contract/Task Order number GHS-I-00-03-00030-00, to support the Rwandan Ministry of Health in the national roll-out of performance-based financing. In addition to technical support to the Ministry of Health, this contract aims at purchasing HIV services based on performance, whilst protecting the quality and quantity of general health services.

This costing study was done to inform performance based financing/performance-based contracting for HIV services in Rwanda. Its purpose was to:

1) Study unit costs for PMTCT, VCT and IO services for 2005
2) Compare, for 2005, the unit costs of HIV services to unit costs of basic health services
3) Make recommendations related to unit fees for the different HIV services using performance-based financing
4) Make recommendations on fees and revenues in a representative sample of Rwandan health facilities

A micro-costing/bottom-up costing methodology using a provider perspective was applied to six health centers in Gicumbi district, studying 2005 costs and revenues. An MSH in-house costing tool, the Cost and Revenue Analysis –Plus (CORE-Plus) tool was adapted for use in the Rwandan context.

Findings from the study can be grouped in four areas. The first are observations related to costs, the second are observations related to revenues, the third are conclusions related to economies of scale, and the fourth are conclusions on Performance-based financing for HIV services.

Costs

Three types of costs have been studied: total costs, average costs and marginal costs. Total costs were on average FRW 37,125,767 (standard deviation 2,887,604; min 33,924,546 and max 40,615,969) including annuities for Capital Outlay and Equipment, and FRW 21,244,194 (standard deviation 2,887,547; min 17,986,724 and max 24,683,552) when excluding Capital Outlay and Equipment. 122,250 services were costed. For average costs, two additional types of costs were calculated; these were weighted and double weighted average costs. Weighted average costs are costs corrected for case-mix, and double weighted average costs are weighted average costs corrected for service volume. Capital Outlay and Equipment annuities were large and represented on average 43% of total costs and 59% of fixed costs. Therefore average costs were also calculated for two sets of data: those with and those without annuities. HIV services (VCT and PMTCT services) at the health center level were not more expensive than common other conditions such as treating bloody diarrhea in child or treating pneumonia which bodes well for horizontal integration and sustainability of these services. At the

integrated services level, costs are strongly related to number of activities; HIV services just like other services, become much cheaper as service production increases.

Average costs, when including Capital Outlay and Equipment annuities:

Per Service	Average Total Cost (FRW)	Weighted Average Total Cost (FRW)	Double-weighted Average Total Cost (FRW)
Paquet Minimum des Activités[1]	2,337 (SD[2] 1,343)	2,051	1,871
VCT	3,318 (SD 970)	2,593	*
PMTCT	3,719 (SD 1,120)	3,279	*

And when excluding Capital Outlay and Equipment annuities (recurrent costs only):

Per Service	Average Total Cost (FRW)	Weighted Average Total Cost (FRW)	Double-weighted Average Total Cost (FRW)
Paquet Minimum des Activités	1,310 (SD 697)	1,321	1,105
VCT	1,960 (SD 350)	1,708	*
PMTCT	2,206 (SD 406)	2,042	*

Revenues

The six health centers have varied sources of revenue. On average, 60% is from state and donor subsidies, whereas 24% is through health insurance (predominantly 'mutuelles' but also employer based and other sources of insurance) and the rest through out of pocket payments. Performance-based financing had not yet been started in Gicumbi district during 2005. Subsidy levels are fairly constant across health centers and there is no relationship between subsidy and activity level. In addition, the health center with the lowest activity level receives FRW 15,499,841 through subsidies whereas another health center with a seven-fold activity level receives FRW 11,879,621. When removing Capital Outlay and Equipment annuities on the cost side, all six health centers had a positive balance, and calculated data compared closely to finances reported through the routine reporting system. Curative health services utilization correlates positively with mutuelle adherence; the higher the mutuelle adherence the higher the utilization of curative services. Mutuelles pay providers on a capitation basis. Stated mutuelle membership does

[1] Basic Health Service Package which includes HIV services.
[2] The Standard Deviation (SD) is a measure of how widely values are dispersed from the average value.

not correlate with the proportion revenue through mutuelles (both capitation payments and gate fees) and health center revenue would benefit from increasing its revenue through mutuelles.

Economies of scale

Human resource usage, especially for health professional staff, was inefficient. Three health centers had staff which did not adhere to their service delivery role and three had underutilization of human resources (all cadres). When analyzing nursing staff, the average number of nurse-patient contacts was less than two per hour. This translates into an uptake of 0.8 services per inhabitant per year for both curative and preventive services, whilst the potential uptake, given the existing nurse staffing and national norms, could be 1.8 services per inhabitant per year. All six health centers studied had considerable short term economies of scale; the marginal revenue, that is, the revenue from producing one more service, was much higher than the cost of producing one additional service (the marginal cost). Increasing the service volume would be beneficial for health centers (more revenue) and for society (lower average costs) alike.

Performance-based financing for HIV services

A first important conclusion is that the bonus fee determined for VCT and PMTCT services, of FRW 500 and FRW 250 ($0.91 and $0.46 in 2007 exchange rates) respectively, bear **no** relationship to the actual cost to the provider of providing these services – not to the economic costs from a provider perspective, nor to the financial costs to the provider when omitting Capital Outlay and Equipment annuities.

Even when omitting Capital Outlay and Equipment annuities, an act not considered wise from a financial sustainability point of view when paying providers through prospective payment mechanisms, the following figures emerge. From the non-weighted average cost for VCT services (FRW 1,960) and the non-weighted PMTCT services (FRW 2,205), FRW 1,227 for tests and laboratory materials needs to be subtracted, as these are donated. Subtracting this material, donated by other sources, such as the CAs (laboratory material) or supplied from central level (VCT tests), leaves a cost of FRW 733 for VCT services and FRW 978 for PMTCT services.

If USAID contemplates purchasing VCT and PMTCT services through an output-based financing scheme, it would need to pay a fair price for these services. A decision to pay a fair price for these services would, however, need to take into account fees paid for other PBF indicators, namely the basic package of health care related ones. There are, therefore, limits to what USAID could pay for such services in order not to destabilize the incentive schemes for other essential services such as antenatal care, institutional deliveries and vaccinations for children.

The bottom line is that the Rwandan national performance-based financing model is not suitable to be considered as ‘case-based reimbursement’ health financing, but rather as a ‘case-based reimbursement’ look-alike. From this perspective it is best to talk about a bonus or incentive system. This finding has **serious** implications for the USG policy related to financing HIV services through the Rwandan PBF system. Namely: the findings imply that financing of HIV services can never be entirely ‘pushed through’ a

PBF system, but that a mix of financing pathways would need to be used: both input and output financing should be combined judiciously.

OI services could not be calculated as such services were embedded in other services and could not be disaggregated. ARV services could not be calculated because, for the study period, ARV services had only been available at the Hospital.

A second conclusion is that paying a performance bonus for HIV services is an attractive proposition as seen from different angles; for the health facility as its income increases and management can use the additional income for increasing staff motivation or for improving structural quality. For USG, as the same amount of input financing leads to a much better quantitative result, therefore leading to a higher efficiency of PEPFAR monies because PEPFAR itself is a results and output oriented program. For the health sector and society as a whole, an increased service production brings lowered Average Total Costs as health centers in general are inefficient and underutilized.

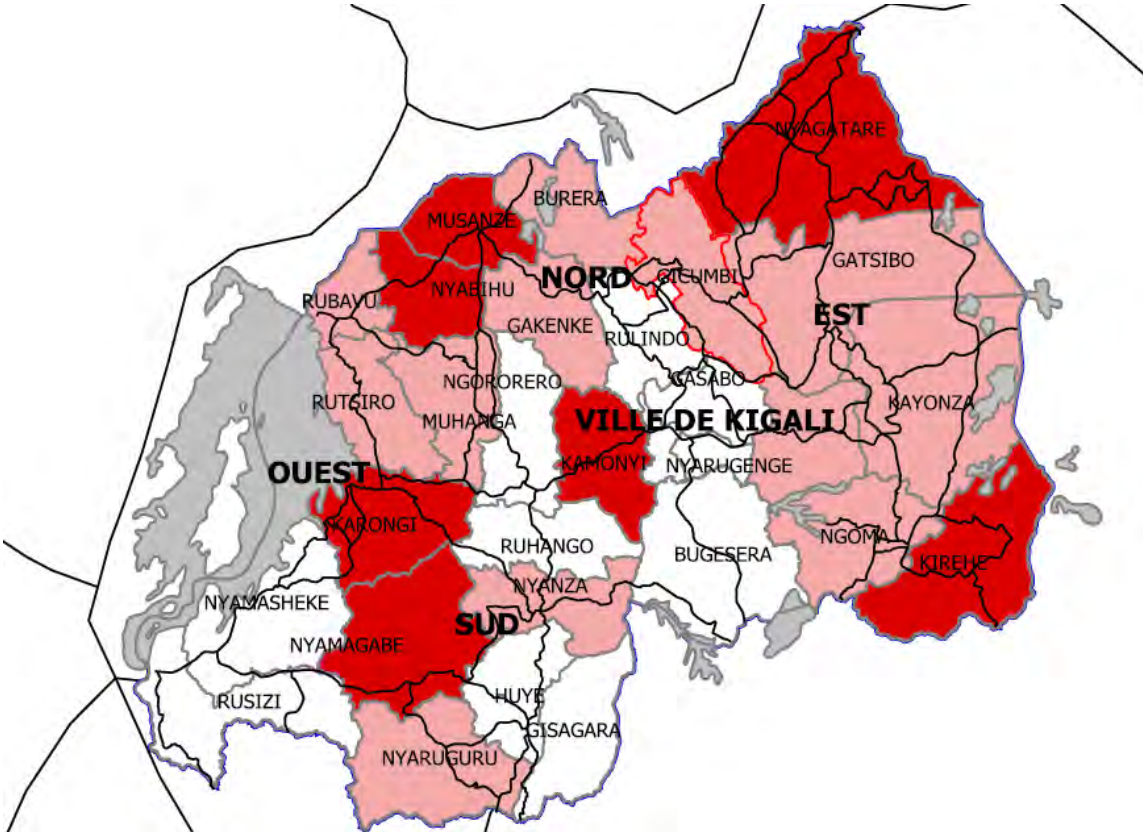
Finally, the combined effects of performance-based financing for basic health services, including HIV services, will lead to a mutually reinforcing effect on efficiency due to significant short-term scale economies.

1. INTRODUCTION AND PURPOSE

1.1 Introduction

Rwanda is a small landlocked country in the Great Lakes Region of east-central Africa, with a 2007 population of 9.26 million. Rwanda is one of the poorest countries in the world and has a typical epidemiological profile for sub-Saharan Africa. The average Rwandan lives on less than US$0.70 per day. Per capita annual health spending averages about US$14 (MOH, 2006a). Rwanda is ranked 158 out of 171 countries in the Human Development Index.[3] It has a GDP per capita of $1,406 ($ in purchasing power parities), about $250 in international dollars, which places it 160th in a list of 190 countries.

Figure 1: Rwanda with Gicumbi District



Rwanda has scaled-up community health insurance, from 27 to73 percent of the population between 2003 and 2006,[4] leading to increased access to health services. One of the key challenges facing policy makers is how to ensure sufficient supply of services of reasonable quality to meet this increased demand. Universal characteristics of health

[3] http://hdr.undp.org/hdr2006/statistics/

[4] Nationwide coverage was 27% 2004; 44.1% 2005 and 73% 2006 (data as per 31 December each year). Information provided by Hertilan Inyarubuga, national Mutuelle coordinator, MOH.

services in poor countries are inefficiency, wasteful use of resources, low quality of services, and an unmotivated work force. Financing instruments available to donors and Governments seem unable to address these core causes in an efficient manner; proof of which is that from sizeable resources made available to the health sector in a country such as Rwanda, only a small portion reaches the health centers (Kalk et al., 2005, Soeters et al., 2006, Meessen et al., 2006). Performance Based Financing (PBF) is an approach to health financing that shifts attention from inputs to outputs, and eventually outcomes, in health services. Whilst inputs are necessary to finance health services, a predominant focus on inputs has failed to deliver significant results. A roll-out plan was designed by the WB to introduce PBF nationwide using two phases (Rusa and Fritsche, 2007).

The Government of Rwanda (GOR) has made performance-based financing (PBF; *l'Approche Contractuelle*) the cornerstone of far-reaching health financing reforms (MOH, 2005, MOH, 2005a, MOH, 2005b). Together with voluntary community health insurance schemes (Mutuelles)[5] (MOH, 2004) and a new Quality Assurance Policy (MOH, 2006b), performance-based financing aims to increase the quantity, quality, and efficiency of health services.

Management Sciences for Health (MSH) has been awarded a contract by USAID through PEPFAR funding, Contract/Task Order number GHS-I-00-03-00030-00, to support the Rwandan Ministry of Health in the national roll-out of performance-based financing. In addition to technical support to the Ministry of Health, this contract aims at purchasing HIV services based on performance, whist protecting the quality and quantity of general health services.

The contract with duration of two years and a renewable option for years 3 and 4 started in September 2005. The main objectives of the contract are (i) to provide technical assistance to the Ministry of Health (MOH) for implementing PBF, (ii) to design and implement financing methods for purchasing HIV service products and (iii) to protect the quality of general health services whilst purchasing HIV indicators.

This costing study was designed with the intention to shed light on the cost of providing basic health services, including HIV services, as seen from a provider perspective. Data from this study will be used to inform health financing in general and performance-based financing in specific. Such data, bar some indicative figures (Kagubare et al., 2005, Kalk et al., 2005, Schneider and Hanson, 2007, Schmidt et al., 2006), were not available for Rwanda. The project needed accurate cost information, through a micro-costing of health services, to inform policy makers on what part of the recurrent costs related to providing HIV services, could be financed using output-based financing.

[5] These community based health insurance schemes, although nominally 'voluntary' are in fact obligatory, as by law, each Rwandan citizen is obliged to adhere to a health insurance, whether the community health insurance scheme, a private health insurance, or a public employer health insurance such as RAMA. The 'Mutuelles' are therefore the default insurance scheme for the overall majority of Rwandans.

1.2 Objectives of the 2006 Rwanda CORE study

The purpose of the study was to:

1) Study unit costs for PMTCT, VCT and IO services for 2005
2) Compare, for 2005, the unit costs of HIV services to unit costs of basic health services
3) Make recommendations related to unit fees for the different HIV services using performance-based financing
4) Make recommendations on fees and revenues in a representative sample of Rwandan health facilities

2. BACKGROUND

2.1 Background of the study methodology

In order to estimate the unit cost of health services from a provider perspective, the study employed a modified version of the MSH Cost and Revenue Plus (CORE-Plus) Analysis Tool, CORE-Plus R. CORE-Plus R is based on a previous tool called the Cost and Revenue (CORE) Tool, developed in 1998 by Management Sciences for Health (MSH, 1998b). CORE-Plus is an excel-based spreadsheet that analyzes costs and revenues, enabling health managers to plan more effectively and observe the financial viability of delivering health services. The tool analyzes and compares costs and revenue for *each* major service offered or condition treated, within an integrated service facility as well as total costs for the facility. The latter differentiates CORE from other costing tools. Additionally, it includes a demographic component that allows the user to model various scenarios and compare real and estimated activities, costs and revenues.

CORE-Plus R uses a bottom-up or micro-costing approach. Rather than employing a more common top-down approach, CORE-Plus R begins by evaluating all costs and revenue associated with delivering a specific health service (e.g. treating intestinal parasites or malaria) including staff time involved in patient interaction, laboratory tests ordered, consumable medical supplies utilized and medicines prescribed. Operating costs are distributed to each health service proportional to the direct cost of the service. Revenue is distributed proportional to the cost of the service. CORE-Plus R allows for various different cost and revenue scenarios to be evaluated.

CORE and CORE-Plus have been used throughout the world. It has been utilized by non-governmental health and family planning organizations in Zimbabwe, Guatemala, Tanzania, Honduras, Uganda, South Africa and Kenya (Newbrander et al., 2003, Vander Plaetse et al., 2005, Collins and Lewis, 2003, Terki and Lewis, 2003, Lewis and Joseph-Pressat, 2005) with technical assistance from Family Planning Management Development Program/MSH to determine the operating efficiency of different modes of service delivery, to review and improve cost-recovery strategies, to review and revise budgets, and to develop an expansion strategy. With technical assistance of Management & Leadership Program (M&L)/MSH, it was implemented by COMBASE, a faith-based organization in Bolivia, and by Profamilia, the International Planned Parenthood affiliate in Nicaragua. Additionally, under the Afghanistan Health Services Enhancement Project implemented by M&L/MSH, an adapted version of the tool was used to cost the Basic Package of Health Services (Newbrander et al., 2007, Newbrander et al., 2003). Most recently, the tool was used by six non-governmental organizations in Haiti to cost the Priority Service Package with technical assistance from Haiti Health Systems 2004 Project (HS-2004)/MSH (Lewis and Joseph-Pressat, 2005).

CORE-Plus was adapted to generate cost and revenue data specific to the health service provider yet to be inclusive of donor materials and funding, generating a complete cost and revenue estimate for each health center studied.

3. METHODOLOGY

3.1 Flow of the Cost and Revenue-Plus R Analysis Tool

The Cost and Revenue-Plus R Analysis Tool is contained within a Microsoft Excel workbook consisting of a collection of more than 50 worksheets. The workbook contains five types of worksheets including: service practice worksheets, scenario selection page, data input worksheets, calculation pages, information summary page, and data report pages.

Service Practice worksheets: There are fifty service practice worksheets (SPW) (one for each service or condition) pertaining to those health services with a significant number of cases. The SPW are the backbone of the CORE-Plus R Tool as they are used to determine the standard staff time required for each service or treated condition (involving all cadres of personnel) as well as the standard quantities and types of drugs, medical consumables and laboratory tests utilized for each particular service or condition.

Scenario selection worksheet: There is one scenario selection worksheet containing four types of scenarios which allow the tool to model the following: variations on costs, services and staffing patterns, variations on donor and state subsidies, variations on coverage of obligatory and non-obligatory insurance schemes (Mutuelle, Gacaca, FARG, etc), and variations in service utilization.

Data input worksheets: There are seven data input worksheets. These worksheets are filled before utilizing the tool to analyze cost and revenue scenarios, but henceforth become static except for periodic updates. These worksheets include:

> Tool Assumptions: This worksheet is used to outline assumptions made during the study relevant to the population, working hours, services offered and streams of donor and state subsidies.
>
> Determination of the quantity of services: This worksheet is utilized to enter the number of services delivered or calculate the number required based on population data entered in the assumptions page and on incidence, utilization and treatment norms.
>
> Personnel costs: This worksheet is used to calculate the number of employees, the proportion of time they spend involved in direct patient care and in an administrative capacity and the cost of each cadre of staff.
>
> Determination of other costs: This worksheet is used to calculate other operating costs such as administrative personnel, utilities, construction and/or renovation, etc.
>
> Costs of drugs: This worksheet calculates the cost of and revenue generated from drugs utilized at the health facility based on data provided by the service provider and central pharmacy. In Rwanda, the discrepancy between the wholesale and retail values can be up as much as 700% for certain drugs (Kalk et al., 2005).

Costs of consumable medical supplies: This worksheet calculates the cost of and revenue generated from consumable medical supplies utilized at the health facility based on data provided by the service provider.

Costs of Laboratory tests: This worksheet calculates the cost of and revenue generated by laboratory tests completed at the health facility based on data provided by the service provider.

Calculation worksheets: There are three calculation pages. These worksheets are predominantly calculation-only pages and require no user manipulation.

Distribution of direct and indirect personnel charges[6]: This worksheet calculates the cost of direct and indirect personnel time according to salary figures entered in the personnel cost worksheet and the average personnel time required per health service based on figures established in the SPW.

Determination of costs: This worksheet is used to calculate total variable costs based on the figures generated in the determination of quantity of services worksheet and SPWs and to regroup costs outlined in the *distribution of direct and indirect personnel charges* and *other costs worksheets*.

Determination of revenues: This worksheet is used to determine the total revenue of the health facility based on revenue information derived from the drug, consumable medical supplies and laboratory test worksheets as well as SPWs and information related to service fees and the *Ticket Moderateur* [7]as reported by the health facility. Additionally, it accounts for subsidy revenue from donors and the GOR to generate the average revenue per specific health service.

Summary worksheet: There is one summary worksheet which summarizes all cost and revenue data reported and calculated in the SPW, data input pages, data calculation pages and according to the selected scenario. It provides standard cost and revenue figures per health service, total costs, total revenue, cost recovery information, staff utilization data (adherence to roles as described in the SPW), cost per inhabitant and average number of services per inhabitant.

Report Worksheets: There are five report worksheets. These worksheets calculate average cost, revenue, public health, general financial, general personnel and utilization statistics per health center per scenario.

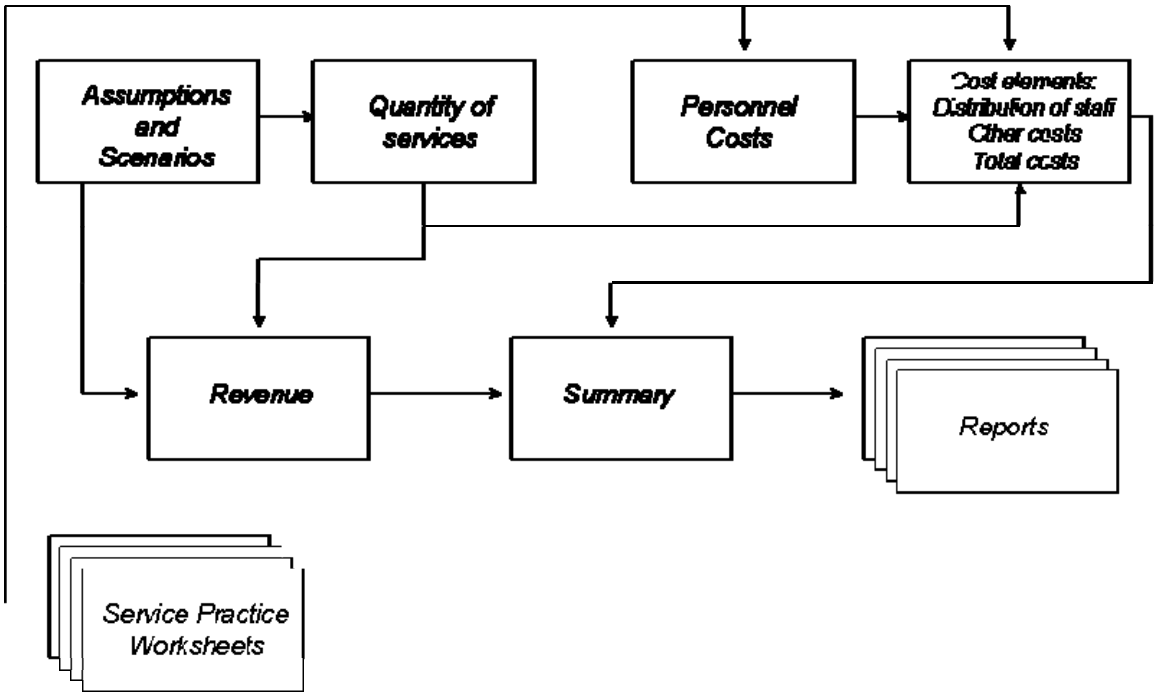
Below is a flow graphic that displays how all worksheets contained in the CORE-Plus R workbook are interconnected to generate cost and revenue data.

---

[6] Direct time is the amount of time a health care provider dedicates to direct patient interaction to deliver a particular service. Indirect time is the amount of time a health care provider dedicates to patient interaction outside of his or her cadre-defined roles and responsibilities and/or "downtime" not spent with patients or administrative work.

[7] The *Ticket Moderateur* is the gate fee or co-payment that *Mutuelle* and/or other insurance program adherents pay whenever they utilize health services. For 2005, this co-payment was FRW100 ($0.18).

Figure 2: Flow Graphic for the CORE-Plus R Worksheets



Assumptions (as detailed in the methods *assumptions* section) are made with regards to standard treatment guidelines and entered in the service practice worksheets. The service practice worksheets inform the distribution of personnel and other variable costs detailed in the personnel costs and other cost element worksheets. Other assumptions and scenario selections inform the quantity of services, cost elements and revenue. Cost and revenue data feeds in to the summary page which informs the report pages.

3.2 Strengths and Limitations of the analysis approach

3.2a Strengths

There are many advantages, as well as limitations, to conducting a bottom-up (micro-costing; activity based costing) rather than a top-down (step down) cost and revenue analysis. Most significantly, utilizing a bottom-up approach to generate unit costs affords a high level of accuracy. In top-down approaches, costs and revenue are treated equally and are generally based on actual costs- not standards- among health services independent of the cost and revenue nature of each particular service, and are proportionally distributed to each health service based on the quantity of health services delivered or other variables such as floor space occupied. Additionally, top-down approaches rely on current macro financial data from the health facility and macro efficiency assumptions based on this data (therefore top down models are not able to identify inefficiencies as easily as a bottom-up approach because it does not use standard direct costs). In contrast, CORE-Plus R begins by building up the basic costs of the major

health services offered by the health facility. By first assigning standard cost and revenue estimates for all categories such as personnel time, drugs, consumable medical supplies and laboratory tests and then proportionally distributing (to these costs) other operating costs and gross revenue, a highly accurate cost and revenue analysis can be compiled based on existing protocols and norms established by the Central MOH and/or the health facility and which relies on micro financial data that tends to be more specific and accurate.

The tool is additionally advantageous as it easily allows for modeling a myriad of scenarios and is able to quickly compile and report data for each scenario. A population component of one of four scenarios additionally allows the user to observe costs and revenue when dealing with actual and necessary service utilization.

CORE-Plus R as well accounts for all donor and government subsidies by considering them both sources of costs and revenue ensuring a most complete analysis.

Finally, the bottom-up approach allows the tool to evaluate existing staffing patterns. In determining the approximate standard time required of all health personnel per health service and multiplying these figures by the total number of health services seen (actual or expected), the tool can provide estimates on the ideal staffing pattern given the utilization scenario as well as cost estimates for this staffing pattern.

3.2b Limitations

The CORE-Plus R Tool and its bottom-up approach has limitations. The backbone of CORE-Plus R is the Service Practice Worksheets, which build the variable, direct costs for all health services with a significant number of cases and from which total costs and revenue are derived (seen annex 8 for an example of such a service practice worksheet). Each service practice worksheet requires assumptions to be made with regards to the amount of time each health service provider should spend with a patient for a particular service on *average,* they also require the user to estimate the quantity of consumable medical supplies, drugs and laboratory tests to be used for each service. In some cases, these are straightforward assumptions. In other cases, estimated components are cumbersome. For example, drugs involved with ARV therapy, depending on the geographical location, drug availability, stage of disease, strain of the virus, past utilization of ARVs, etc. can vary immensely. In this case, generation of an accurate drug regimen estimate requires seemingly broad assumptions.

Furthermore, the assumptions made related to service practices are only as good as the consensus that led to these assumptions. As the Government of Rwanda does not currently have any standard treatment guidelines, development of service practice worksheets depended on expert opinion derived from Rwandan health professionals. Observing provider practices, in addition, seemed to be a very cumbersome and time-consuming activity. In the service treatment practice workshop animated discussions ensued between providers from a plethora of backgrounds and differing levels of professional knowledge. Doctors, on average, would know what the practices should be, nurses, in contrast, often were more aware of actual practices and eventual protocols. The picture that emerged was one of quite frequent irrational drug use which although

probably reflecting current practice, might not be the desirable treatment as seen from a public health point of view.

Although most health centers predominantly provide outpatient care, there are cases that require brief hospitalizations at the health center. Although the tool most accurately estimates costs and revenue associated with outpatient visits as they are less variable with regards to costs and revenue generated by the service, hospitalization costs have also been included based on estimates provided by Rwandan health professions. This process involved estimating, for instance, what percentage of diarrhea cases would require admission and, if admitted, what resources would be required for the admission.

The process for completing the service practice worksheets were: first, filling the treatment practice worksheets by two experienced international public health physicians, second, a two and a half day workshop early May 2006 with 15 plus health professionals from the central MOH quality assurance department, MSH project technical staff and Gicumbi district hospital staff to discuss and finalize these treatment practice worksheets. The HIV treatment practice worksheets were worked through in separate sessions with Gicumbi Hospital doctors, IHI, FHI and EGPAF key technical national and international staff. The construction of the HIV treatment practice sheets went through an iterative process where data provided by one agency were triangulated by a second, etcetera. A treatment practice worksheet for opportunistic infections (OI) could not be created as no such specialized service existed; OI services were embedded in other health services and incidence data were not available.

Finally, as stated above, CORE-Plus R can easily account for donor and GOR subsidies as both a cost involved in providing a health service *and* a source of revenue, but the tool assumes that the subsidies are intended for utilization within the timeframe of the study. However, only donations in-kind were included in costs, cash donations and subsidies were only included as revenue. That is, if a donor provides FRW 150,000 worth of pregnancy tests in a particular year, the tool assumes that these tests will be utilized only in that particular year. The tool assumes the same for other costs such as large drug procurements. As Rwandan Health Centers purchase their own drugs through their ‘drug account’, in general care is taken by health center managers to avoid purchasing excessive stocks of any item.

3.3 Data Collection Methodology

3.3a Round One

Byumba Hospital senior staff, hospital supervisors and health authorities were briefed on the purpose of this study, to ensure their buy-in. Gicumbi health authorities in fact were very interested in results from this study, as it would possibly shed light on some of their ‘un-known’s’ related to unit costs for health services. As providers were reimbursed on a capitation basis, patients were complaining that they were getting insufficient medical attention, i.e. were prescribed lesser drugs according to their perception, and providers were complaining that the contribution from Mutuelles was insufficient to pay for their costs involved in treating Mutuelle adherents.

IntraHealth International (IHI) is a partner in our project and was supporting HIV services in Gicumbi district. This district would have the first batch of HIV services that would be put under performance-based financing. The choice for sampling health facilities in Gicumbi to study was therefore easily made. Six health facilities were chosen, all health facilities at the time – March 2006- that had HIV services in Gicumbi district. These health facilities were: Byumba CS, Mukono CS, Munyinya CS, Rutare CS, Rwesero CS and Rushaki CS. Although ARV services have, between 2005 and 2007, been introduced in three health centers (Rwesero, Mukono and Rushaki), ARV services for the entire year 2005 were only provided in Byumba Hospital. As the objective of the study was rather studying HIV services relative to other basic health services, we could not study ARV services, as these were only provided at the Hospital. Basic health services (which included HIV services) were studied in the six health centers.

Gicumbi district was chosen because it would be the first district in which MSH was supposed to start Performance-based financing for health services. A total of 21 health centers exist in Gicumbi. The six facilities were:

- Byumba CS (government owned)
- Mukono CS (government owned)
- Munyinya CS (government owned)
- Rushaki CS (FBO)
- Rutare CS (government owned)
- Rwesero CS (FBO)

From these health centers, one is a semi-urban health centre (Byumba CS); the remaining are rural health centers. Approximately 45% of all Rwandan health facilities are run by faith based organizations, therefore the representation of FBO run health centers (33%) is low in this convenience sample. FBO-run health centers; in general, have a better reputation related to quality of care and management. Government run/public health centers have a higher percentage of staff paid by the Ministry of Health although FBO run health centers also have some staff on the government pay-roll, most typically the head of clinic. IntraHealth International (IHI) as supporting HIV services in Mukono, Munyinya, Rutare and Rwesero, the Global Fund was supporting services in Byumba and Rushaki.

The following data are for 2005. The six health centers cover a population of 148,151 (38% of Gicumbi district population), with an average of 24,692 (9,164-34,747) per health center. The norm is one health center per 20,000 catchment population (MOH, 1999). The number of curative consultations per capita per year is 0.63 (SD 0.24; spread 0.34- 1.02). The total number of services, including curative services, per capita per year, is 0.82 (SD 0.31; spread 0.57-1.41). Family planning coverage varies between 2.7% and 12.7%. The percentage institutional deliveries are 35% (25%-46%). For HIV services; the VCT uptake is 4.7% (1%-10%) and for PMTCT services the average uptake is 71.6% (31%-96%). The data, as they come from different sources, one the GESIS, the other from the TRAC databases, are not fully concordant. For instance, whilst the PMTCT uptake in one health center is calculated at 96%, the ‘First ANC uptake’ for the same

health center, according to the GESIS, is 62.7%, which is quite unlikely.[8] Routine reporting systems are famously unreliable (Murray et al., 2003). The TRAC databases are more reliable as USG collaborating agencies and the TRAC do separate data audits.[9] See annex 7 for more details and summary statistics.

Basic data collection at the health facilities was done during a two-week period; from 27 March to 5 April 2006, by a group consisting of MSH staff, a consultant, the director of Health of Gicumbi district, a member from the Hospital supervisory team and a representative from the office for decentralization and integration. A questionnaire, based on data necessary for completing the standard CORE-Plus tool for each health center was utilized. This questionnaire collected information, for 2005, on exact staffing patterns, salaries and benefits, numbers of days worked on average, numbers of days of sick leave, maternity leave or otherwise, numbers of days of training and so on. Additional information on finances, productivity and drug prices was also collected. At the district level, available 2005 data were collected from the District Hospital GESIS database.

Collecting accurate data for Mutuelles proved hard leading to conflicting and incomplete information on this crucial aspect of revenues. In fact, with the available information, the complexity of the income and financing pathways of Rwandan health centers became apparent. The CORE-Plus tool was not appropriate to do the type of in-depth data entry of the multitude of complex assumptions and variables, a fact which was compounded by the collected incomplete and, sometimes, conflicting data; the tool had to be adapted (see below under 3.3b).

The treatment practice worksheet workshop was held in Kigali on 4, 5 and 6 May 2006.

At central level, the central MOH GESIS and the national TRAC databases were consulted, IntraHealth International provided initial HIV service practice information. Information that was later triangulated with Byumba Hospital staff, FHI and EGPAF.

3.3b Final data collection

Final data collection occurred in April and May of 2007. There were remaining gaps in information after the first round of data collection necessitating this second round. Most gaps pertained to missing information related to the Mutuelles. Gicumbi Health District Mutuelle staff was interviewed regarding the functioning of the mutuelle system in the district in 2005 (the year from which study data is derived). The survey which guided this interview is in Annex 1.

In this second round of data collection, a survey was distributed to the director of each health center during a face to face interview. The interview and survey were designed to

[8] A possible explanation, apart from poor reporting of Primary Health Care indicators through the GESIS, is that women from neighboring catchment areas attend this Health Center, due to the absence of PMTCT services in their Health Centers.

[9] This phenomenon is corroborated during the regular control activities for the PBF indicators in Gicumbi July 2006 onwards: verified data are frequently discordant for the same indicators reported in GESIS, whilst the HIV indicators reported in the TRAC reports, for instance for VCT and PMTCT activities, show a near 100% concordance.

collect supplementary data related to health center staffing patterns, complete salary, bonus and salary top-off information, laboratory tests and services offered by each health center and the approximate population coverage of the Mutuelle and other insurances. Other health and administrative staff were consulted when the director was unable to answer all questions.

Donor agencies providing financial and in-kind support to the health facilities involved in this study were contacted and, when pertinent, informally interviewed in order to collect disaggregated (when available) data related to their financial support in 2005.

Finally, missing primary health care utilization data, revenue and cost data were collected from the Ministry of Health (MOH) of Rwanda, Health Information System personnel, both at the central and at Gicumbi district level.

3.4 Modifications to CORE-Plus

Based on data collected from the health centers, donor agencies and MOH Rwanda, the CORE-Plus Tool was modified to accommodate a highly diverse cost and revenue system. The modified tool has been named CORE-Plus R. Three types of scenarios were added to the tool, necessitating a new worksheet specifically for the selection of scenarios. Scenarios added to the tool allow the user to select whether or not donor and/or MOH subsidies are calculated as revenue to explore financial sustainability of each health center in the context of a dynamic subsidy environment. Additionally, a scenario was added to explore the changing role of the Mutuelle and other insurance programs and the financial sustainability of these programs. Finally, a scenario was created to observe the financial effect of changes in utilization, easily allowing a sensitivity analysis of cost and revenue data.

The Assumptions page was expanded to account for a lack of standardization among health centers for various procedures including insurance coverage, subsidies and laboratory tests offered at each facility. Additionally, the revenue determination worksheet was expanded in order to account for subsidies from multiple donor agencies and the Central Level MOH.

Finally, additional Report worksheets were developed in order to analyze the many scenarios contained within this adaptation of the CORE-Plus R tool. Additional report worksheets include Cost reports per scenario per health service, Revenue reports per scenario per health service, Top-ten consultations report, a General public health data report, a general financial statistics report and lastly a human resources report.

3.5 Data input and analysis

Data input and analysis occurred after the standard CORE-Plus R template had been adapted, tested and finalized. Service utilization, cost and revenue data provided by the MOH Rwanda was, in general, partially incomplete with data missing for various months. Incomplete data was annualized in the following fashion:

$$(\text{Total reported}_{X\ data} / \#\ \text{months reported}) \times 12\ \text{months} = \text{Annualized Total}$$

As well, comparison of monthly health center reports to HIS data yielded data input errors that were corrected on an *ad hoc* basis as pertinent to the study.

3.6 Study Assumptions

As previously mentioned, utilization of a bottom-up approach to analyze health center costs and revenue required a number of assumptions to be made and conventions to be used. These are differentiated by the type of assumption made and how it was used within the context of the study.

General assumptions: General assumptions about the catchment population, insurance plan coverage, availability of health facility staff, average salaries and benefits of health facility staff, and product price markups where made in the *assumptions* worksheet.

> Catchment population: the total catchment population was assumed to be the population as reported by the health center in 2005 multiplied by the market share percentage (consistently 95%) as it is assumed that 5% of those living within the catchment area will seek traditional forms of medicine. This figure was reported by the health centers. Additionally, population statistics disaggregated by age group and sex were derived from the US Census Bureau, Population Division/International Programs Center[10] for Rwanda as a whole. It is assumed that the same population distribution is pertinent for the health centers involved in this study in Gicumbi Health District.
>
> Insurance plan coverage: Health Centers self-reported their actual 2005 insurance plan coverage disaggregated by plan type (Mutuelle, Gacaca, FARG, AGRI, Secteur Informel, RAMA, Caisse Social) and/or lack of plan (indigent population or population paying the full health service fee).
>
> Availability of Health Facility Personnel: based on figured reported by health facilities, it was determined that health facility personnel are available between 207 and 211 days/year. These figures were determined based on the total number of days per year the health facility is open (normal operating hours) minus the average number of vacation, sick and training days as well as holidays. This figure is further refined to account for the percentage of time that each employee

[10] U.S. Census Bureau, Population Division/International Programs Center, http://www.census.gov/ipc/www/idbpyr.html

is assumed to be providing direct patient care versus being engaged in administrative duties. This is assumed for each health facility staff member *and* globally for staff in general per health facility (average of health center-reported percentage per employee).

Average staff salaries and benefits: CORE-Plus R uses actual salary and benefits data as reported by the Health Centers in determining actual and normative[11] costs, but utilizes estimated salary and benefit figures when determining costs associated with the *Ideal staffing* scenario. Estimated salary figures for all cadres of staff were derived from *Guidelines for Fixing Salaries in the Rwandan Public Sector* (GOR, 2004) and average benefit figures were self-reported by health centers.

Product mark-up: Health Centers self-reported the average mark-up they place on their costs for drugs, consumable medical supplies and lab tests. This average mark-up was used to determine revenue generated by the sales.

Depreciation of Medical Equipment: The value of the medical equipment was derived from an estimate, provided for 2007, by a knowledgeable MOH source, involved in purchasing equipment for newly built MOH health centers. The value for 2007 was deflated to 2005 costs using the real Rwandan inflation rates (Kumaranayake, 2000, Minecofin, 2007). An average lifetime of five years was assumed, with a 3% discount rate and an average inflation of 7%. The annuity factor is 3.7908, the annuitized value therefore is 28,977,088/3.7908 = 7,644,056. This represents on average 16% of the total cost of the health center. Here, as below for Capital Outlay, the annual equivalent Economic Costs of the equipment is taken. Another approach would have been to take the Financial Cost of the equipment and divide this by the expected years of useful life (Creese and Parker, 1994). In the case of Equipment there would not have been a large difference (28,977,088/5=5,795,417), however this approach will create a larger discrepancy between these two measure for Capital Outlay (8,210,743 for the Economic Cost versus 3,600,000 for the Financial Cost). As our study aims at assessing how output payments can contribute to financing health service provision at the health center level, the concept of either the full Financial Cost (which includes a straight line depreciation for equipment and capital outlay) and certainly full Economic Cost seem less helpful. We have therefore chosen to present two sets of costs: one set without the annual value of equipment and capital outlay, the second set with the full Economic Cost. In the first set of costs we assume that the cost of the equipment and capital outlay have been taken in year 1, i.e. before the onset of our study period.

Standard Treatment Guidelines: As described in the methods section, there are no standard treatment guidelines in Rwanda, and the study therefore assumes that the

[11] Within the context of this study, "normative" refers to the predicted or expected utilization of drugs, supplies, and lab tests if the guidelines established in the service practice worksheets are followed.

treatment guidelines utilized in the service practice worksheets are accurate, average estimates of personnel time and medical supplies utilized by the health centers.

Standard Treatment Guidelines for "Other" Health services: A good portion of curative consultations reported by the health centers were classified as "Other." These health services do not adhere to any of the specific health service treatment guidelines. A service practice worksheet was therefore created that assumes that all health services with this general classification are treated in a standard fashion with regards to costs and revenue. A generic treatment protocol was developed to account for personnel time and the average costs and revenue for all health services for drugs, consumable medical supplies and laboratory tests were assumed.

Donor and State Subsidies: Health Centers were asked to self-report subsidies received from donor agencies and the Government of Rwanda for payment of personnel salaries and bonuses. Additionally, donor agencies were asked to self-report both cash and in-kind subsidies donated to each health center. These quantified subsidies are assumed to be accurate estimates of both costs and revenues for 2005. In some cases, detailed, line item actual figures were not available from donor agencies and in-kind donations had to be extrapolated from available data.

Donor and state support are assumed to be annual costs attributed to health services and annual revenues. Given the subsidies are independently reported figures and not proportionally calculated as a function of anticipated costs or service utilization, they are static and are assumed to remain so despite modeling of scenarios.

Buildings: Information on Capital Outlay was not available, neither in the central MOH buildings department, nor at the district or the health center level. All health centers had been constructed a while back, most before the war. As no information was available we obtained the current cost of constructing a comprehensive health center FRW 90 Million.[12] We then assumed a 25 year average life span of for such a building, took a 3% discount rate and an average inflation of 7%. The annuitized value of the capital outlay for 2005 was therefore FRW 8,210,743 (Drummond et al., 1999).[13] This figure was assumed to be the same for each health center. It is clear that the apportioned annual capital cost using the above methodology could be higher than the actual cost. Building a health center say in 1991 could lead to a lower annuitized sum in 2005 than taking the 2007 cost of constructing a health center and deflating this sum to 2005, when we assume that it was cheaper to construct a health center in 1991 than in 2007. However, lacking actual construction costs for the health centers forced us to take this, quite conservative, approach. Constructions done in Rushaki and Byumba CS during 2005 paid for by the Global Fund were similarly treated (25 year average lifespan, AF10%). This represents on average 17% of the total costs of health service delivery. Costs of service provision will be provided with and without capital outlay and medical equipment, for comparison sake.

[12] Information obtained from the MOH construction department.

[13] Assume average inflation over a 10 year period is 7%, assume discount rate of 3%. FRW 90 M deflated to 2005 Francs is 74,528,910. Assume 25 years lifetime for these buildings. Annuity Factor (AF), 25 yrs, 10% (7% + 3%) = 9, 0770. The annuitized value for 2005, therefore, is 74,528,910/9.0770 = 8,210,743.

Accuracy of HIS data: The study assumes that service utilization data, cost and revenue data are accurately reported within the National Health Information System. This is not necessarily the case. Evidence from existing pilot performance-based financing programs (Cyangugu, Butare and Kigali Ville pilot programs) showed near universally two phenomena. The first was that during reinforced control and verification exercises after introduction of performance-based financing, fairly large discrepancies were noted for near all routinely reported health indicators. Even for such common indicators such as 'number of new curative consultations' or 'completely vaccinated children'. This is a quite common and well-described phenomenon, demonstrated by large variations between routinely reported data and the outcomes from Demographic and Health Surveys across a wide range of countries and cultures (Murray et al., 2003). Sometimes the errors that were observed were in both directions; either too low or too high. The second phenomenon showed that after a certain time, due to the reinforced control and verification exercises, that routine data became much more reliable. The above phenomena have also been observed during the 2006 roll-out of performance-based financing nationwide.

In order to verify suitability of utilization data, a sensitivity analysis was performed. Using the costing model developed in the CORE Plus-R tool, the cost of health services was calculated with determined variations in utilization data of +/- 5%. The standard deviation of the resulting average cost per health service for each scenario (-5%, actual, +5%) was then calculated.

Adherence of personnel to their assigned roles/responsibilities: The study assumes that personnel of a specific cadre adhere to the roles and responsibilities of their assigned cadre when providing health services. That is to say that it is assumed that an A2 nurse does not perform the duties of a social assistant. As this is not the case at the health centers, the time of the personnel that is spent filling another personnel role is labeled as *indirect personnel time* and the cost of this indirect time is proportionally distributed to the health services which utilize the staff member in their actual capacity. For example, if an A2 nurse acts as both an A2 nurse (80% of the time) and a social assistant (20% of the time), the proportional cost (80%) of her time is first distributed to the ten health services that require her A2 nurse time as *direct personnel time* and the cost of the rest of her time (20%) is then distributed to those same health services as *indirect staff time* regardless of whether or not these health services require the time of a social assistant.

Ideal quantity of administrative staff: The study assumes that the ideal quantity of administrative staff is one accountant for all health centers.

Average, Weighted average and Double-weighted average costs: The study examined Total Costs, Average Total Costs and Marginal Costs. Three types of average costs were studied; average, weighted average and double-weighted average costs. Average cost per health service is calculated as:

$$Total_{HC\ costs} / Total_{service\ delivered} = Average\ cost\ per\ health\ service$$

Weighted average costs weight the average costs based on the health center case mix. It is calculated as follows:

- Health Service A: Cost of Health Service A * (Total number of Health Service A produced in 2005/ Total number of health services in 2005) = Health Service A contribution to weighted average
- Health Service B: Cost of Health Service B * (total number of health service B produced in 2005/ total number of health services in 2005) = Health Service B contribution to weighted average
- Health Service C: Cost of Health Service C * (total number of health service C produced in 2005/total number of health services in 2005) = Health Service C contribution to weighted average

Health Service A contribution + Health Service B contribution + Health Service C contribution + …Health Service X contribution = weighted cost for each health service. We can then add up these weighted costs and divide by six to get a weighted average cost for an average health service.

For example, health center 1 offers two types of health services and in a particular year delivered 100 total services. If health service A has a unit cost of $1 and 90 of these services were delivered in that year, then the total cost of these services would be $90. If health service B has a unit cost of $100 and only 10 of these services was delivered in that year (for a total of 100 services), then the average cost per health service would be:

$90 + $1000 = $1090 / 100 services = **$109** per health service

Using the weighted methodology described above:

[$1 * (90/100)] + [$100 * (10/100)] = $.90 + $10 = **$10.90** per health service

Double weighted average costs weight the weighted average as regards to the total number of services produced during 2005. We need to do this as a health center which offers 40,000 services per year has lower average costs than a health center that offers 6,000. So by doing a weighted average of six weighted averages (double weighted) we are able to develop a double weighted cost figure per service valid for all six health centers.

It is assumed that all three averages are accurate measures of health service unit costs.

4. RESULTS

4.1 Costs

There are two cost categories: variable costs and fixed costs. Variable costs consist of the following costs which fluctuate given a particular health service case mix:

- Drugs
- Consumable medical supplies
- Laboratory tests

Fixed costs are those costs that are independent of the health service case mix of a particular health facility. They include:

- Direct personnel time
- Indirect personnel time
- Other functioning costs
- Annuitized Capital Outlay
- Annuitized medical equipment

Variable costs in general are those that can vary within a certain, limited period of time, say one month. Fixed costs are those costs that can be varied in the long run. From this perspective, personnel time can either be treated as fixed costs and as a variable cost: as about 50% of all health workers in Rwandan health facilities are contract workers, and a large pool of unemployed health staff resides in the capital, in principle, the health facility could quickly boost the number of health personnel given the resources (Furth et al., 2005a, MOH, 2006c).

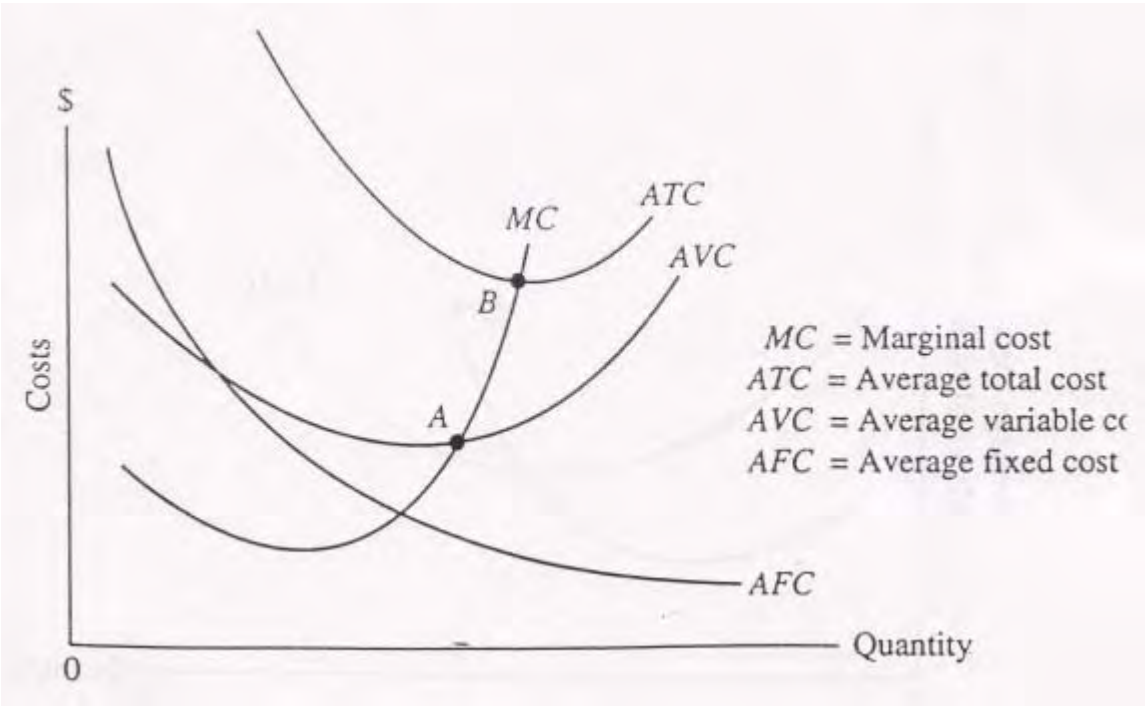
There are three ways in which to present and to examine costs, each in their own right; as Total Costs, as Average Costs and as Marginal Costs ((Jacobs, 1997).

1. Total Costs: are considered from the point of view of the health facility. The total costs (TC) are the sum of all resources used to produce the outputs; it consists of the Total Variable Cost (TVC), the sum of all variable inputs, and the Total Fixed Cost the sum of all fixed costs. TFC do not vary in the short run (labor, other functioning costs and Capital Outlay and equipment remain the same). As near half of all health workers in Rwanda are contract workers, personnel can be increased fairly easily. TVC increase with each single additional service. Examining the number of services per provider suggests that the number of services can be increased significantly –albeit to a differing degree- using existing human resources in all six cases (on average these services could be doubled). As the TFC do not change, the total cost for one additional output will only be the TVC associated with that output (i.e. drugs, consumables and laboratory tests), as TC = TVC + TFC. At one point, the TVC and TC curves will level off: when

efficiency gains have been obtained, TFC will have to increase (adding of new staff) to increase production. Although the 'technology' used in primary health care is primarily labor, and not much efficiency gains can be obtained by changing the technology, different strategies can be initiated to increase the outputs. For instance, additional human resources could be used to have more women deliver in the health center, or to do more effective follow-up of nutritional status in the community.

2. Average Costs: this is the value of resources to produce one single service or unit of output.

Figure 3: relation between costs and outputs



The Average Total Costs (ATC) depends on the Average Variable Cost (AVC) and the Average Fixed Costs (AFC). The figure above represents the theoretical behavior of health care costs. Point A is the intersect between the AVC and the MC curve; the production level at which the marginal cost of production are equal to the average variable cost of production. Point B is the intersect between the marginal cost curve and the average total cost curve. Beyond point B, the marginal costs of production are higher than the average total cost of production. The ATC is the TC/Quantity (of services produced), the AVC is the TFC/Quantity and the AFC is the TFC/Quantity. The average fixed costs decrease with each additional unit of output as the fixed costs are distributed over an increasing number of outputs. In our study, assuming that the health centers can be compared – assuming that all production factors are the same which is not the case for when e.g. case mix or quality are differing, the ATC falls with an increasing output but seems to level upwards (see figures 4 and 5).

3. Marginal Costs: the value of additional resources needed to produce one additional service or unit of output. In our case, as we consider labor to be a fixed costs and because this labor is used very inefficiently and lots of room exists to increase production with the same level of fixed costs, the marginal costs are the cost of drugs, consumables and laboratory tests used, and as long as these are lower than the average total costs, a further increase in the output will continue decreasing the Average Total Costs. We therefore take the Average Variable Cost as a proxy for Marginal Cost. For all six health centers, and for the average of these health centers, the average variable cost is lower than the revenue (see tables 1 and 2 below).

Table 1: average total costs and average variable costs (including Cap Outlay)

Health Center	ATC	Av Revenue	% VC	% FC	AVC
Health Center 1	2,275	956	24%	76%	546
Health Center 2	1,860	1,180	30%	70%	558
Health Center 3	2,244	1,246	29%	71%	651
Health Center 4	1,825	695	30%	70%	548
Health Center 5	2,366	1,678	28%	72%	662
Health Center 6	4,782	2,797	26%	74%	1,243
Average	2,559	1,425	28%	72%	712

Table 2: average total costs and average variable costs (excluding Cap Outlay)

Health Center	ATC	Av Revenue	% VC	% FC	AVC
Health Center 1	1,460	951	45%	55%	657
Health Center 2	1,108	1,180	50%	50%	554
Health Center 3	1,341	1,246	50%	50%	671
Health Center 4	1,443	693	50%	50%	**722**
Health Center 5	1,333	1,678	49%	51%	653
Health Center 6	2,506	2,797	48%	52%	1,203
Average	1,532	1,424	49%	51%	745

- Increasing service volume by 5% for each of the six health centers, leads to a decrease of the Average Total Cost per service for all six health centers. This can be explained by the production of more services, with the same Fixed Costs: the Average Fixed Costs will decrease as these costs are distributed over a larger number of outputs.

- For all six health centers it is efficient, and economically interesting, to produce more services, as the Average Variable Cost are less than the Average Revenue.

When excluding Capital Outlay and Equipment annuities, in only one health center (health center 4 in table 2) is the AVC higher than the Average Revenue.

- Economies of scale are obvious in all six health centers, as more services can be produced by the available human resources, bar perhaps in Health Center 3, which is producing 4.38 services per nurse per hour, close to the norm of 5 services per nurse per hour. Modeling an increase of 5% of the number of services leads to the Average Total Cost per service to decrease in all six health centers.

4.1a Costs of Top Ten Health Services and HIV services by facility

Table 2 provides actual cost data for the combined top ten health services delivered by the six health centers and HIV services including VCT and PMTCT (see also annex 2). No cost data was generated for ARV as this service was only available from one health center for three months in 2005. The below figures include annuity for Capital Outlay and Equipment.

Table 3: Top 10 Cost Data, including HIV services, Including Capital Outlay & Equipment

	Facility A	Facility B	Facility C	Facility D	Facility E	Facility F	Weighted Average
Top 10 Consultations	*Actual Cost (FRW)*						
Under-five Clinic	7,903	N/A*	10,869	6,044	N/A*	14,368	7,714
Fever of unknown origin and presumed malaria (Adult)	920	1,046	1,111	612	1,489	2,041	1,168
Upper Respiratory Infection (Child)	873	982	956	513	1,087	1,416	792
Upper Respiratory Infection (Adult)	720	771	775	410	886	1,159	636
Prenatal Consultation	424	515	385	243	620	862	465
Voluntary Testing and Counseling (VCT)	2,644	3,786	3,467	1,890	3,406	4,717	2,593
Intestinal Parasite (Child)	499	392	430	217	547	702	331
Intestinal Parasite (Adult)	446	342	389	193	492	630	298
Fever of unknown origin and presumed malaria (Child)	1,186	1,436	1,449	802	1,826	2,503	1,486
Lower Respiratory Infection (Child)	2,557	3,115	2,956	1,752	3,136	4,200	2,713
HIV/AIDS services							
Voluntary Testing and Counseling (VCT)	2,644	3,786	3,467	1,890	3,406	4,717	2,593
Preventing Mother to Child Transmission (PMTCT)	3,133	4,064	3,644	2,052	3,981	5,439	3,279

**Utilization data for Under-five clinic services was not available from two health centers therefore costs are not reported/annuitized* [14]

[14] The costs associated with health services with 0 reported cases are drugs and supplies only. They do no incur any personnel cost, but if they were to be delivered then they would. They would also take on a larger portion of other costs

Table 4 below provides the actual cost of top 10 services, including HIV services, assuming that Capital Outlay and Equipment cost have been taken in a 'year 1', prior to 2005 and thus excluded in these figures (for further details see annex 3). Note that some facilities had a significant amount of capital outlay and equipment charges whereas other facilities had very little. Thus the exclusion of these costs has a large impact on costs in some facilities and little to no impact in others.

Table 4: Top 10 Cost Data, including HIV services, without Capital Outlay and without Equipment

	Facility A	Facility B	Facility C	Facility D	Facility E	Facility F	Weighted Average
Top 10 Consultations	*Actual Cost (FRW)*						
Under-five Clinic	4,911	N/A	6,514	4,798	N/A	7,290	5,244
Fever of unknown origin and presumed malaria (Adult)	605	616	638	448	812	1,056	676
Upper Respiratory Infection (Child)	587	578	556	399	610	760	508
Upper Respiratory Infection (Adult)	488	453	449	317	499	627	409
Prenatal Consultation	293	302	217	183	346	457	285
Voluntary Testing and Counseling (VCT)	1,672	2,252	2,064	1,491	1,867	2,412	1,708
Intestinal Parasite (Child)	357	226	240	166	317	400	218
Intestinal Parasite (Adult)	320	197	218	147	285	360	196
Fever of unknown origin and presumed malaria (Child)	774	848	839	599	997	1,293	868
Lower Respiratory Infection (Child)	1,724	1,838	1,792	1,405	1,770	2,263	1,701
HIV/AIDS services							
Voluntary Testing and Counseling (VCT)	1,672	2,252	2,064	1,491	1,867	2,412	1,708
Preventing Mother to Child Transmission (PMTCT)	2,026	2,409	2,152	1,613	2,199	2,833	2,042

4.1b Sensitivity Analysis

A sensitivity analysis (+/- 5%) of utilization statistics derived from the national HIS was done. The standard deviation of variance analysis ranged from FRW 15.36 to FRW 70.51 per average health service per health facility (see also methodology section).

4.1c Weighted costs of top ten health services and HIV services

Cumulative weighted average costs per top ten health services and HIV services for all health centers are listed below in Table 5.

Table 5: Weighted average costs of top ten health conditions and HIV services

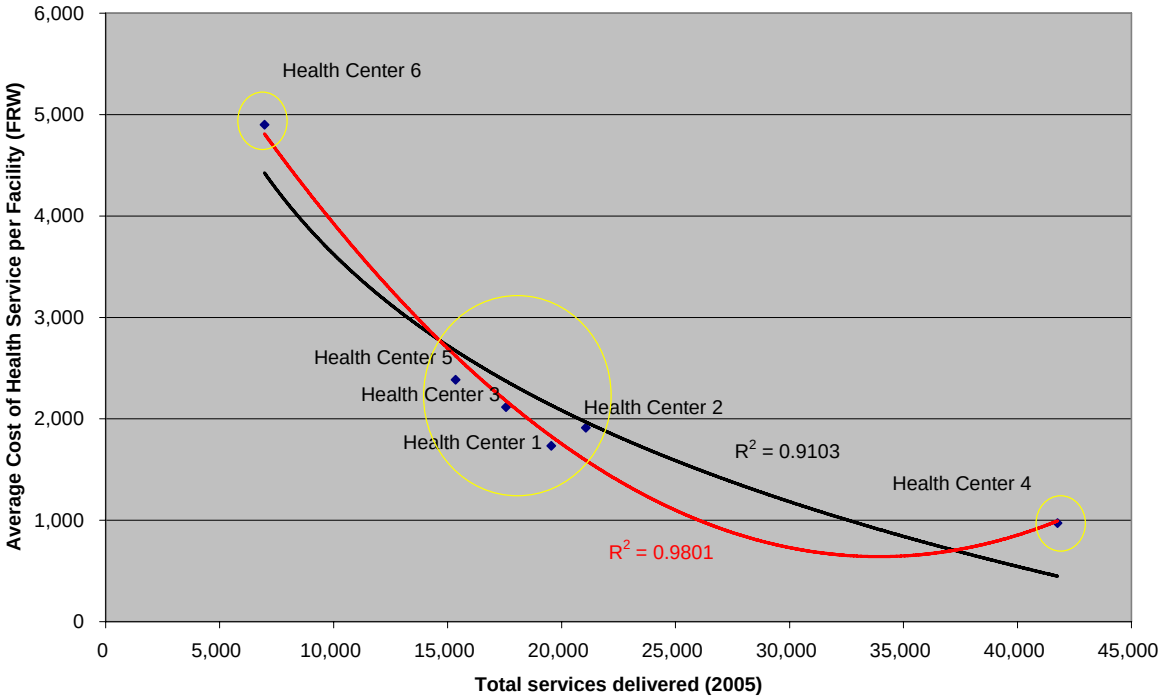
Top 10 Consultations	Cost (FRW) **Excluding** Capital Outlay	Cost (FRW) **Including** Capital Outlay
Under-five Clinic[15]	5,244	7,714
Fever of unknown origin and presumed malaria (Adult)	676	1,168
Upper Respiratory Infection (Child)	508	792
Upper Respiratory Infection (Adult)	409	636
Prenatal Consultation	285	465
Voluntary Testing and Counseling (VCT)	1,708	2,593
Intestinal Parasite (Child)	218	331
Intestinal Parasite (Adult)	196	298
Fever of unknown origin and presumed malaria (Child)	868	1,486
Lower Respiratory Infection (Child)	1,701	2,713
HIV services		
VCT	1,708	2,593
PMTCT	2,042	3,279

[15] 'Under-five clinic' is those services concerned with vaccinating children. This cost is high; for each visit in the service practice worksheet a lump sum figure of 1/5th of the costs of fully vaccinating a child was taken. This lump sum figure was obtained from the national EPI coordinator.

4.1d Non-weighted average cost per health service

Average Total Cost per service was **FRW 2,337** (SD 1,343). In USD terms: Average Total Cost per service was USD$4.17 (SD $2.40).[16] This calculation included Capital Outlay and Equipment, based on 2005 cost of constructing and equipping such health centers, for which the Economic Cost was taken (AF, 25 years, 10% for Capital Outlay, and AF, 5 years, 10% for Equipment). Two best-fit trend-lines have been put between the six data points, of which the one in red shows the best fit. The curve obtained suggests a relationship between an increased service volume, and a decrease in average total costs. In reality, each individual health center 'point' is a point on its own Average Total Cost curve and case-mixes and other factors differ.

Figure 4: **Average Total Costs Including Capital Outlay and Equipment**[17]



From this data, it is possible to extrapolate three types of health centers:

- Low volume, high unit cost,
- Medium volume, medium unit cost,
- High volume, low unit cost.

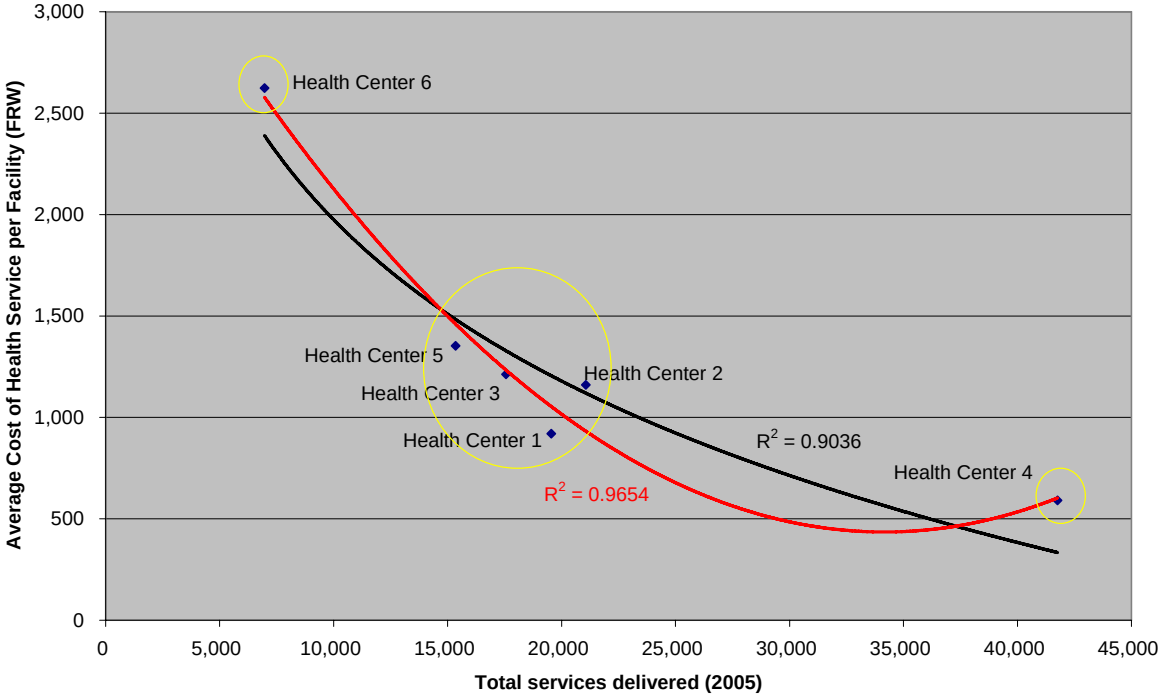
Given the observance of three types of health centers, three non-weighted average health service unit costs can be extrapolated. These non-weighted average unit costs per type are

[16] The average FRW – USD exchange rate for 2005 was 1 USD = 560 FRW.
[17] Health Center 1 is Byumba, HC 2 is Mukono, HC 3 is Munyinya, HC 4 is Rushaki, HC 5 is Rutare CS and HC 6 is Rwesero.

FRW 4,900 (low volume, high unit cost); FRW 2,037 (medium volume, medium unit cost) and FRW 973 (high volume and low unit cost).

Taking the full Economic Cost does not always make sense for decision makers; also, taking the annual Financial Cost equivalent of Capital Outlay and Equipment (through straight line depreciation) is not always useful, depending on the aim of the analysis. Therefore, costs are also presented without Capital Outlay and Equipment, assuming that these costs have been taken in "a year 1", prior to 2005;

Figure 5: Average Total Costs Excluding Capital Outlay and Equipment



Average Total Cost was **FRW 1,310** (SD 697); US$ 2.33 (SD $1.25). This Average Total Cost is dependant on case-mix, and when controlling for case-mix, the Weighted Average Total Cost is $3.45.

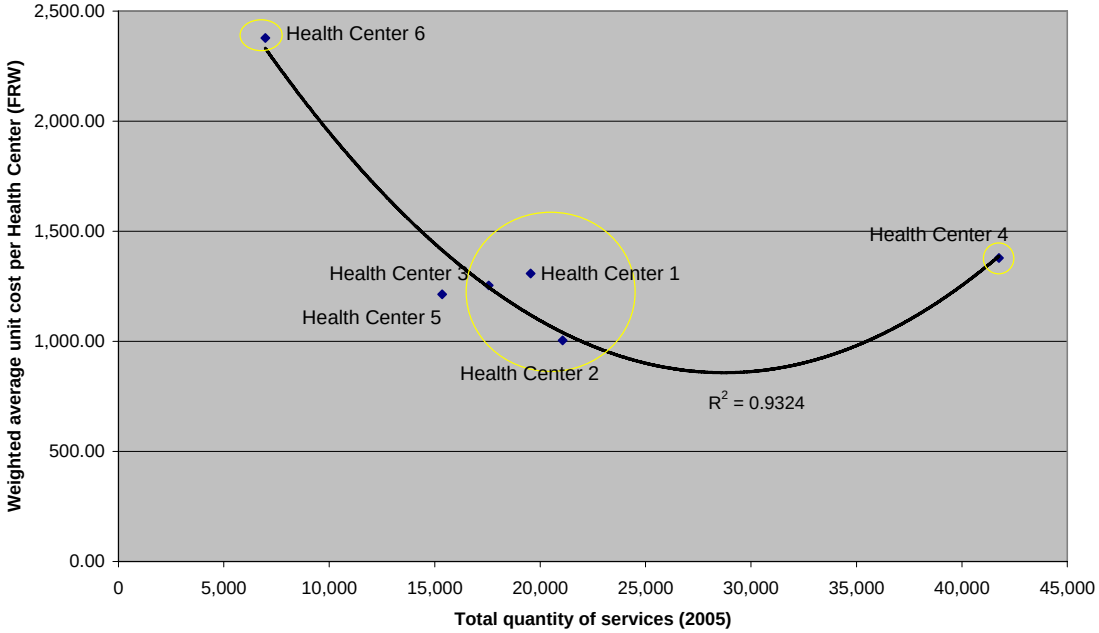
The non-weighted average unit costs, which exclude Capital Outlay and Equipment, for the three distinct categories are FRW 2,624 (low volume, high unit cost); FRW 1,162 (medium volume, medium unit cost) and FRW 591 (high volume and low unit cost).

4.1e Weighted Average Total Costs for an average health service

The weighted Average Total Cost for an average health service is the weighted average when considering service case mix. The weighted Average Total Cost for all health centers is **FRW 2,051** (with Capital Outlay) and **FRW 1,321** (without Capital Outlay).

Health Centers adhere to the same volume category, but to distinct cost categories when this analysis is completed as is seen in Figure 6.

Figure 6: **Decrease in *weighted* Average Total Cost as total quantity of services increases**



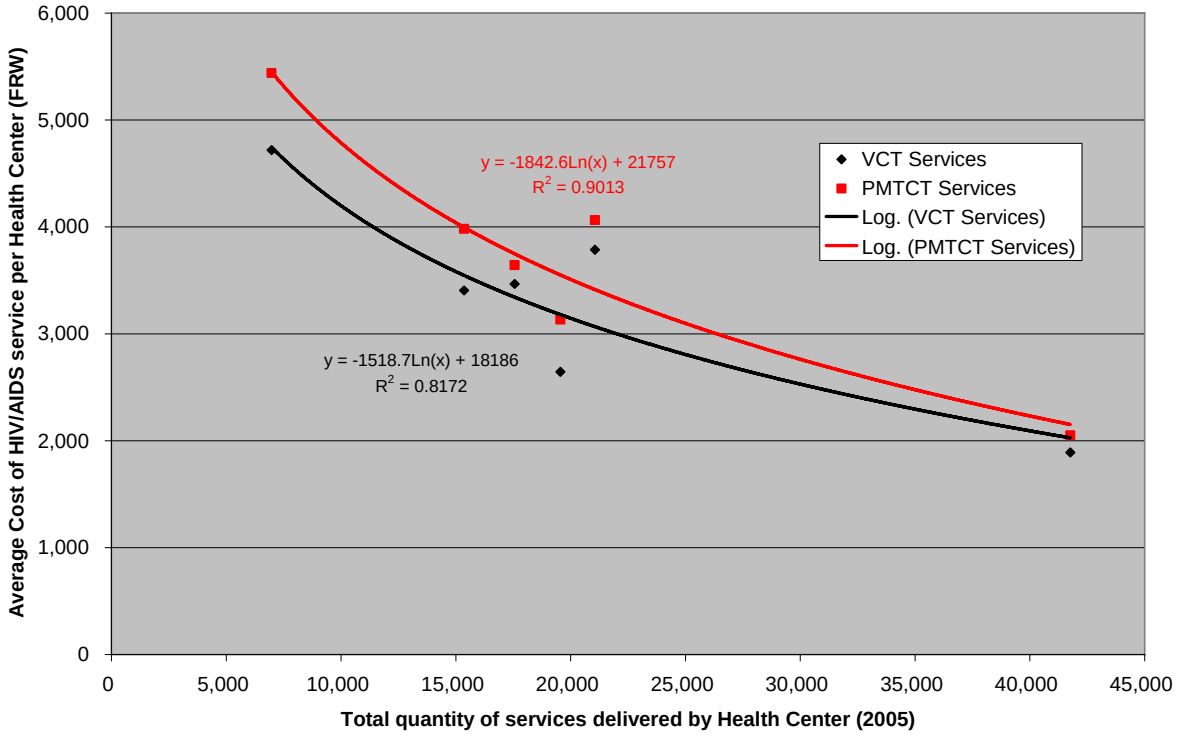
In fact, separate production unit (health centers) cannot be put on the same graph if production factors differ, as the health centers might be on different cost curves. Factors include case mix, quality of care, the technology used, the amount of fixed costs used in the production and so on (Jacobs, 1997). In our case, the quality of care is comparable, see table 13 in the discussion section, and the technology is comparable. Fixed costs vary slightly per health facility as the number of health personnel differs, however, annuity for capital outlay and equipment was taken to be the same. The same polynomial relationship is seen when looking at the average cost curve. However, Health Center 4 is now markedly higher. It seems that around 30,000 services per year, that best efficiency levels are reached.

4.1f Comparative costs of HIV services

The average (non-weighted) cost of VCT and PMTCT services fluctuate relative to the total number of services offered by the health center. As illustrated in Table 2, the range of costs of VCT is **FRW 1,890** to **FRW 4,717** (**average 2,996**) and the range of costs of PMTCT is **FRW 2,052** to **FRW 5,439 (average 3,359)**. When removing Capital Outlay and Equipment annuities, the VCT range is FRW 1,491 to FRW 2,412 (average 1,960) and for PMTCT, FRW 1,613 to FRW 2,833 (average 2,206); see annex 11 for a breakdown.

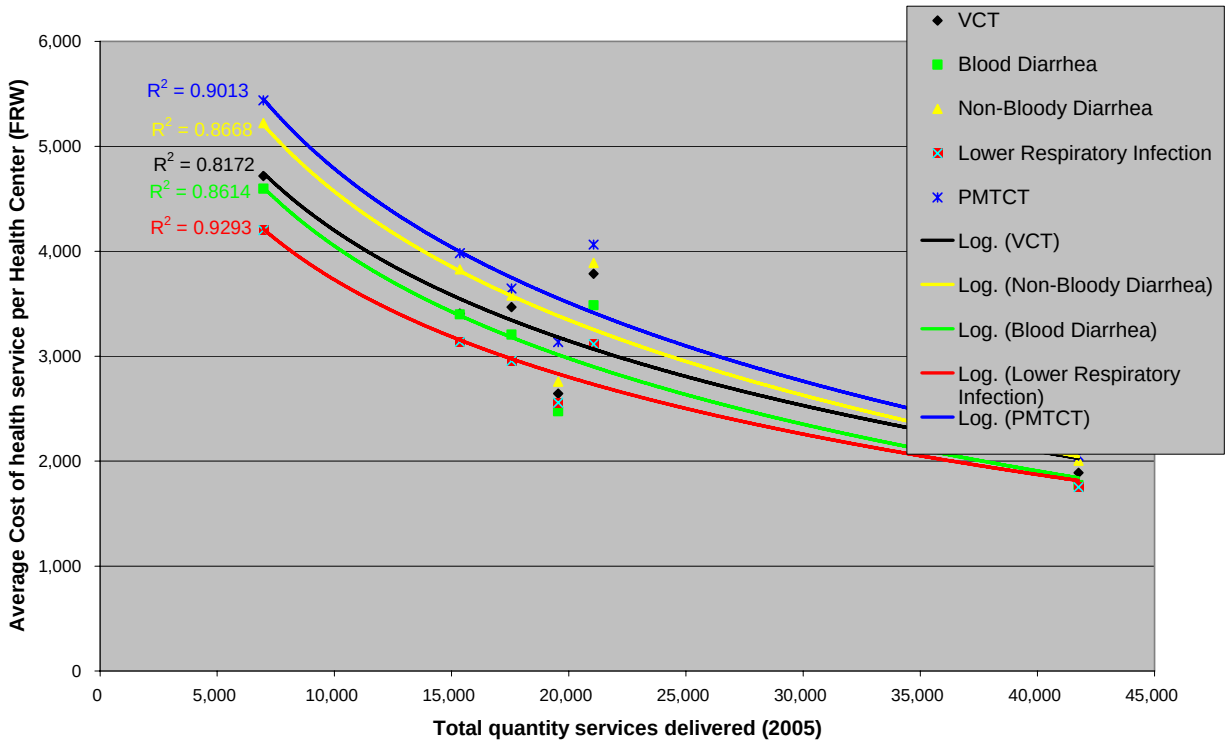
Figure 7 below plots the cost of VCT and PMTCT as a function of total number of health services delivered at each health center. Again, a trend line can be extrapolated where we observe a decrease in the cost of delivering VCT and PMTCT services as the total number of services offered by the health center increases.

Figure 7: **Decrease in cost of delivering HIV services as a function of total services delivered**



VCT and PMTCT are comparable in cost to many commonly treated ailments such as non-bloody and bloody diarrhea and lower respiratory infections, both the costs of treating adults and children. Figure 8 below illustrates that cost of HIV services proportionally fluctuate with the cost of common child curative consultations at all health centers.

Figure 8: **Common decrease in cost of health services as total quantity of services delivered increases**



4.2 Sensitivity Analysis

As discussed in the methodology section, there were discrepancies noted between the health center reports and the data contained with the GESIS. As service utilization figures potentially have a large impact on cost data a +/- 5% variance analysis was completed for service utilization statistics used for the estimation of cost figures. The variance analysis yielded small variations in cost figures.

4.3 Staffing Patterns

4.3a Health Center Staffing

The study yielded data relevant to actual and ideal staffing patterns per health center. For a full review of actual and ideal staffing patterns for all cadres of staff as well as additional staffing information, please refer to Annex 4.

In general, health centers were not appropriately staffed in order to adhere to assumptions made in the service practice worksheets signaling that staff is compelled to fill multiple roles outside of their job description. Frequently higher cadres (and pay) staff completes the work of lower cadre (and pay) staff. Figure 9 below illustrates the difference in actual and ideal staffing patterns.

Figure 9: Comparison of actual and ideal staffing patterns per health center

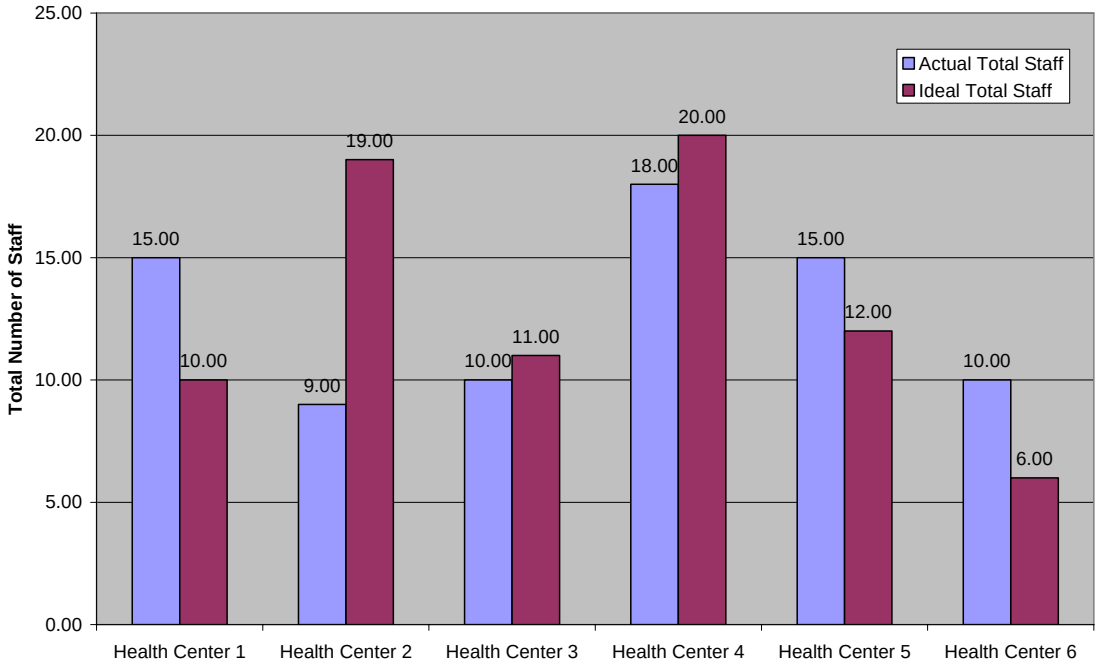


Figure 9 is directly related to the minute calculations related to presumptive staff utilization in the work practice sheets. It reflects all categories, including cleaners. The figures hide variations in proportions of staff (e.g. relative more or less nurses). However, from this quick comparison, it is clear that 50% of health centers have too much staff (all categories combined).

4.3b Adherence of staff to service delivery role

Health Center personnel are **not** adhering to their roles as prescribed by the service practice worksheets. The study calculated the average adherence rate of staff to their service delivery role. A figure of 100% indicates that staff is, on average, adhering to their roles 100% of the time. These 'roles' are tied to the time allocated to each of the 50 conditions or services, of health center personnel dealing with one such case. For instance, see below in figure 10, concerning time involvement of staff for a VCT service. Total time for all staff combined is estimated at 33.5 minutes, out of which 17.9 minutes on average, for the A2 nurse.

Figure 10: Service practice worksheet: allocation of time to service delivery staff

Section 1 : Temps du personnel de prestation — *Service: VCT* — *Par cas ou par visite?*

Activité	Méd	A1	A2	A3	Trav	Nutr	Animat	Labo	Aux	Ass Soc	Total
	Temps de prestation de services (en minutes) par catégorie du personnel										
Enregistrement : trouver le dossier			3.5							1.5	5.0
Information/éducation du public en matière des IST/SIDA			1.1							0.5	1.5
Pre-test			6.0							4.5	10.5
Test								6.0			6.0
Post-test			7.4							3.2	10.5
											0.0
											0.0
Total : Temps du personnel de presta	**0.0**	**0.0**	**17.9**	**0.0**	**0.0**	**0.0**	**0.0**	**6.0**	**0.0**	**9.6**	**33.5**
Par visite:	**0.0**	**0.0**	**17.9**	**0.0**	**0.0**	**0.0**	**0.0**	**6.0**	**0.0**	**9.6**	**33.5**

As these staff time assessment have been filled using expert panels, the calculated times can differ substantially from the real, actual service, that took place. For instance, and this can lead to issues related to quality, when a nurse spends on average 6 minutes per client rather than the assumed 17.9 minutes. In the above situation, expert opinion decided that, in a certain percentage of cases, the 'assistant social' rather than the A2 nurse does certain acts, this has also been observed in the HIV HR assessment. This reflects the 'real world' situation as opposed to guidelines.

In the Rwanda HIV/AIDS HR assessment, the average time involvement of a nurse for a pre-test and a post-test was measured through participant observation in 20 randomly selected sites (Furth et al., 2004b). This fluctuated considerably, see table 6 below.

Table 6: comparison between observed service practice and those derived through expert opinion: the case of VCT testing

	Group IEC average	Pre-test counseling	Post-test Counseling HIV - clients	Post-test Counseling HIV + clients	Average time
Rwanda HIV-AIDS HR assessment	2.5 min (group size 15 and 38 minutes)	20 min (8.5-21.8)	12 min (4.8 – 14.1)	16 min (8.8 – 23.2)	34.5 min
CORE PLUS-R service practice worksheet	1.5 (group size 20 and 30 min)	10.5 min	10.5 min	(included in the average post-test Counceling time assumption)	22.5 min[18]

In the specific example of VCT services, our expert group, for IEC, took an average group size of 20, with an average duration of 30 min (above average group size 15, duration 38 minutes), for the remainder, the data are comparable. The Rwanda HIV HR assessment figures above as the main figure, was the average of those facilities that adhered to at least 70% of the national norms to carry out these activities. The variance,

[18] The total time taken for such a VCT test, including testing and registration, is 33.5 minutes

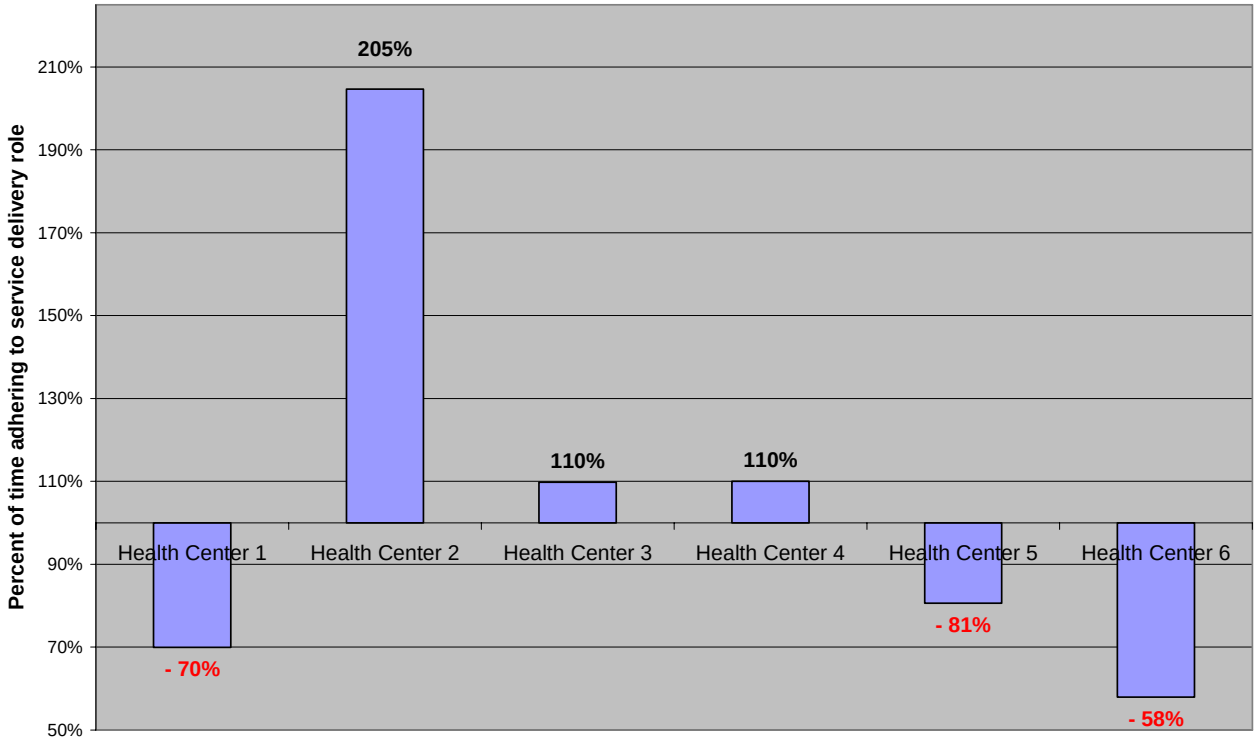
including all measured/observed times, is provided between brackets. The above figures are comparable to assumptions used in other similar costing studies (Geffen et al., 2003).

A figure less than 100% "adherence rate" indicates that staff are performing the duties of other staff involved in service delivery **or** are unoccupied for X % of time, where X % = 100% - actual average adherence rate.

A figure greater than 100% adherence rate indicates that staff is working more than the average number of full-time equivalent days as assumed by the tool to fulfill their cadre responsibilities. All health centers deviated from the norm of 100%. Figure 11 below illustrates the average deviation per health center. The biggest problem here is that the Health Centers do not have laboratory technicians, auxiliary staff or 'assistants socials', which means that A2 nurses are doing the job and, thereby, not adhering to their roles, see table below.

D2. TOTAL DE TEMPS DIRECT (en minutes)	*Temps disponible (en mn.) :*	*Total time required to provide health services*
Médecin	0	0
Infirmièr(e) A1	0	0
Infirmièr(e) A2	443,520	549,942
Infirmièr(e) A3	0	29,421
Travailleur	70,560	131,665
Nutritionist(e)	50,400	531
Animateur(se) de Santé	0	0
Laborantin(e)	0	224,629
Auxiliaire	0	111,753
Assistant Social	0	107,487
TOTAL : TEMPS DIRECT (EN MINUTES)	**564,480**	**1,155,428**

Figure 11: Adherence of health professional staff to their service delivery role

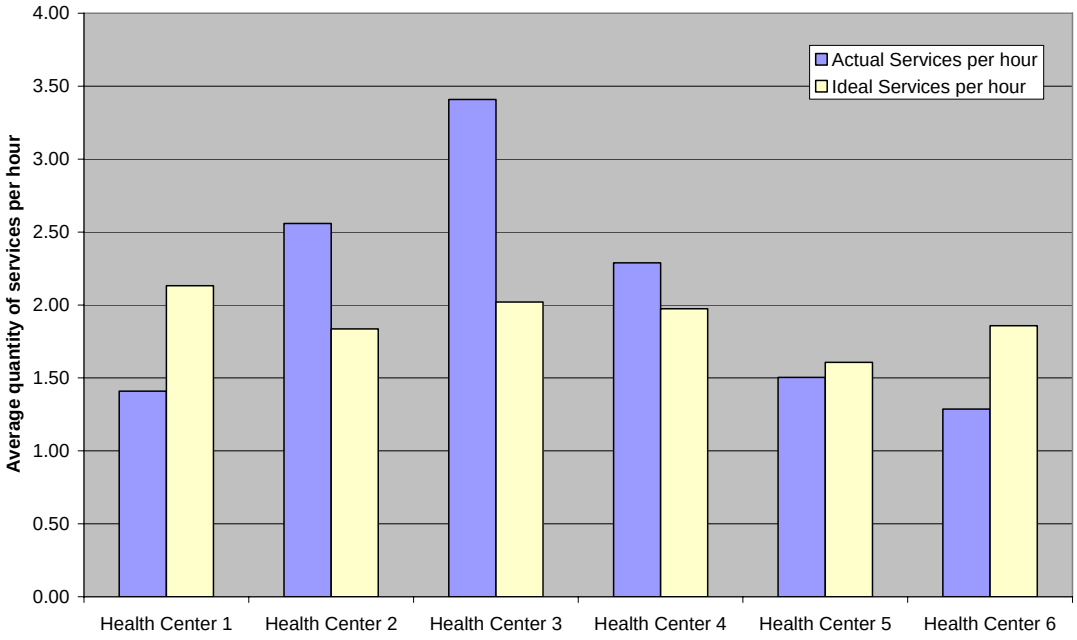


Health Center 2 has probably a disequilibrium related to staffing patterns, with nurses that, according to the service practice worksheets, are doing many more services than indicated by 'the norm'. Two health centers are slightly off by 10%, whilst three health centers seem to have a lot of 'down time', or a frequent non-adherence to their service delivery roles.

4.3c Staff efficiency, average services per hour

The study yielded additional data indicating a lack of efficiency of health center personnel as calculated by the ideal number of services per hour versus the actual number of services per hour per health center personnel. The ideal average number of services per hour is calculated based on the quantity of personnel time per cadre of staff per health service as assumed in the service practice worksheets. Figure 12 below indicates the actual and ideal average number of services per hour per health center as well as the percent deviation from ideal. The numbers provided are per health center staff, all staff combined. This is slightly confusing, as in normal circumstances, we look at number of services per, for instance, nurse, instead of combining all cadres. However, at a quick glance, in two health centers (health center 2 and 3), there are too many services offered relative to staff, in one health centers (4) it is slightly more than ideal ('ideal' as extracted from the service practice worksheets), and in three health centers, there is under-provision.

Figure 12: Actual and ideal quantity of services per hour per health center personnel



However, when we look at number of services per nurse per hour, and the total number of services per inhabitant per year, we see the following (see table 7):

Table 7: Actual number of services per hour per nurse and actual number of services received per inhabitant

Actual Number of Services Provided per Nurse per Hour						
	# nurses	*Hr Avail/Nr/Yr*	*2005 Catchm. Pop*	*Tot. Serv Deliv.*	*Actual No Serv/Nurse/hr*	*Actual No Serv/capita/Year*
Byumba Disp.	9	11,923	37,747	19,553	1.64	0.52
Mukono CS	6	7,949	26,228	21,062	2.65	0.80
Munyinya CS	3	3,974	21,634	17,557	4.42	0.81
Rushaki CS	9	11,923	29,671	41,756	3.50	1.41
Rutare CS	7	9,274	26,702	15,355	1.66	0.58
Rwesero CS	4	5,299	9,164	6,968	1.31	0.76
Average CS	6.33	8,390	25,191	20,375	2.53	0.81

The average number of services per hour (assuming 209 days available for work, with 80% direct patient contacts, and the rest administrative work and 'downtime'), for these six health centers is 2.5/nurse, with a large variation between health centers (1.3 - 4.4). This is well below the recommended average of 5 services per nurse per hour (MOH, 2006c). In the former Kabutare 'public health district' PBF pilot, large variations in productivity of health workers was also noted; from a low of 0.18 services/C/Yr to a high of 1.54 services/C/Yr (Meessen et al., 2006).

Table 8: Potential number of services per hour and potential number of services received per inhabitant

Potential Number of Services per Capita per Year						
	# nurses	*Hr Avail/Nr/Yr*	*2005 Catchm. Pop*	*Pot Services*	*Pot No Serv/Nurse/hr*	*Potential No Serv/Capita/Year*
Byumba Disp.	9	12,038	37,747	60,192	5	1.59
Mukono CS	6	8,026	26,228	40,128	5	1.53
Munyinya CS	3	4,013	21,634	20,064	5	0.93
Rushaki CS	9	12,038	29,671	60,192	5	2.03
Rutare CS	7	9,363	26,702	46,816	5	1.75
Rwesero CS	4	5,350	9,164	26,752	5	2.92
Average CS	6.33	8,471	25,191	42,357	5	1.79

In table 8 above, the potential number of services, based on the actual staffing patterns in these six health centers is shown. The potential number of services per inhabitant per year is 1.79 whilst the actual calculated number is 0.81. All six health centers have potential to offer more services with exactly the same fixed costs (fixed costs including human resources), some more than others. However, as there is a large unemployed nurse labor force in Rwanda (estimate about 1,436 nurses) (Furth et al., 2005a), in addition to the fact that over half of all nurses in public and faith-based health facilities are contract workers, production capacity could be increased significantly, given the resources and the right incentives.

However, even without adding additional human resources, the inherent productivity potential in Gicumbi district health facilities and by extrapolation to all Rwandan health facilities is obvious.

4.5 Revenue and Cost Recovery

4.5a Sources of Revenue

The health centers that were part of this study adhere to a diverse revenue system including revenues from central government and donor subsidies, revenues from insurance plans such as the Mutuelle, FARG, Gacaca, plans provided by the agriculture and the "informal" Sectors and tariffs charged per service, drug, laboratory test and consumable medical supply.

Given the complexity of the revenue system as well as an apparent lack of adherence to established policies on the standardized charging of tariffs, an accurate revenue model could not be generated for 2005 data. Thus, actual or annualized revenues from tariffs were utilized.

4.5b General Revenue observations

Table 9 provides an overview of revenue per health service of the top ten health services and HIV services.

Table 9: Actual revenue per top ten health conditions and HIV services

	Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6
Top 10 Consultations	*Actual Cost (FRW)*					
Under-five Clinic	2,707	N/A	5,167	1,659	N/A	7,691
Fever of unknown origin and presumed malaria (Adult)	520	715	735	422	1,246	1,431
Upper Respiratory Infection (Child)	477	680	634	324	905	988
Upper Respiratory Infection (Adult)	414	559	545	291	788	845
Prenatal Consultation	278	403	345	233	546	669
Voluntary Testing and Counseling (VCT)	1,024	2,194	1,790	659	2,018	2,689
Intestinal Parasite (Child)	354	360	390	247	616	610
Intestinal Parasite (Adult)	323	326	366	233	575	563
Fever of unknown origin and presumed malaria (Child)	620	933	896	476	1,433	1,680

	Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6
Lower Respiratory Infection (Child)	1,225	1,923	1,665	850	2,148	2,576
HIV/AIDS services						
Voluntary Testing and Counseling (VCT)	1,024	2,194	1,790	659	2,018	2,689
Preventing Mother to Child Transmission (PMTCT)	1,366	2,425	1,925	803	2,526	3,220

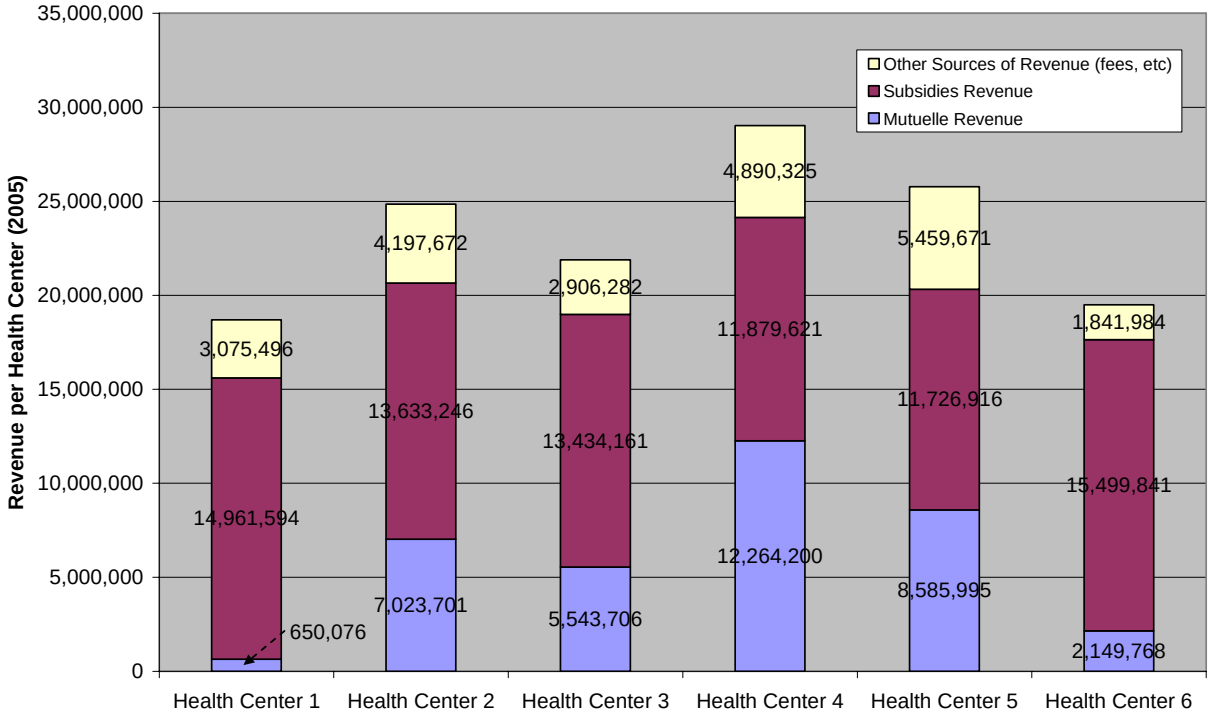
**Utilization data for Under-five Clinic was not available (not reported) from two health centers therefore revenues could not be allocated.*

Refer to Annex 3 for a full review of revenues per health service per health center.

4.5c General Revenue Mix by Health Center

Revenue mix varied considerably by health center. Figure 13 illustrates the revenue mix per health center.

Figure 13: Revenue mix per health center



For example, Health Center 1 relied heavily on subsidies from the state as well as donors (80%), but did not particularly rely on revenue from the Mutuelle (3.5%). Conversely, Health Center 4 relied equally on Mutuelle revenue (42%) and subsidies (40%).

4.5d Revenue from the Central Government and Donor Subsidies

As demonstrated in Figure 13, revenue from the central government and donor subsidies generally accounts for a majority of total health center revenue, approximately **60%** on average. Subsidy levels remain relatively constant across health centers with an average of FRW 13,738,813 ranging from FRW 11,726,916 to FRW 15,499,841 for 2005. There is **no** relationship between activity level and these subsidies.

4.5e Affect of subsidies on service utilization

There is **no** observed significant correlation between subsidies per capita per year and a change (+/-) in service utilization (services per capita per year). In addition, the health center with the lowest number of activities receives FRW 15,499,841, and the one with a seven-fold activity level receives FRW 11,879,621.

4.5f Revenue from the Mutuelle Social Insurance Program

As seen in Figure 8, another significant portion of revenue is generated through the *Mutuelle* Social Health Insurance Program, approximately **24%** on average. The total *Mutuelle*-related revenue per health center ranges from FRW 650,076 to FRW 12,264,200. Revenue fluctuates with the percent of the population enrolled in the Mutuelle program and catchment population. Nevertheless, it is assumed that, given the great range of *Mutuelle*-related revenue, the FRW 650,076 figure (Health Center 1) is likely either incorrectly reported through the routine reporting system (GESIS) or the revenue is somehow influenced by the fact that the health center is situated in a semi-urban setting. It should be noted that the *Mutuelle* revenue figure self-reported by the health center was substantially greater than that contained in the GESIS. For these reasons, analysis of *Mutuelle* revenue excludes data from this health center and the revised range of *Mutuelle* revenue is FRW 2,149,768 to FRW 12,264,200.

4.5g Affect of Mutuelle revenue on service utilization

There is a correlation (R^2=0.4302) between the mutuelle revenue per capita and the total per capita curative services in 2005 when five health centers, as cited above, are studied. Nevertheless, if one additional health center is excluded there is a very strong correlation (R^2= 0.9561) observed. Figure 14 below shows, as the per capita revenue from *Mutuelle* increases so does the quantity of services per capita. Mutuelle adherence boosts service utilization, predominantly for curative services. Figure 15 shows that average costs decrease when service utilization increases whilst figure 16 shows the relationship between the percentage Mutuelle adherence and number of service provided.

Figure 14: Observed increase in curative service utilization as a function of increased Mutuelle per capita income during 2005

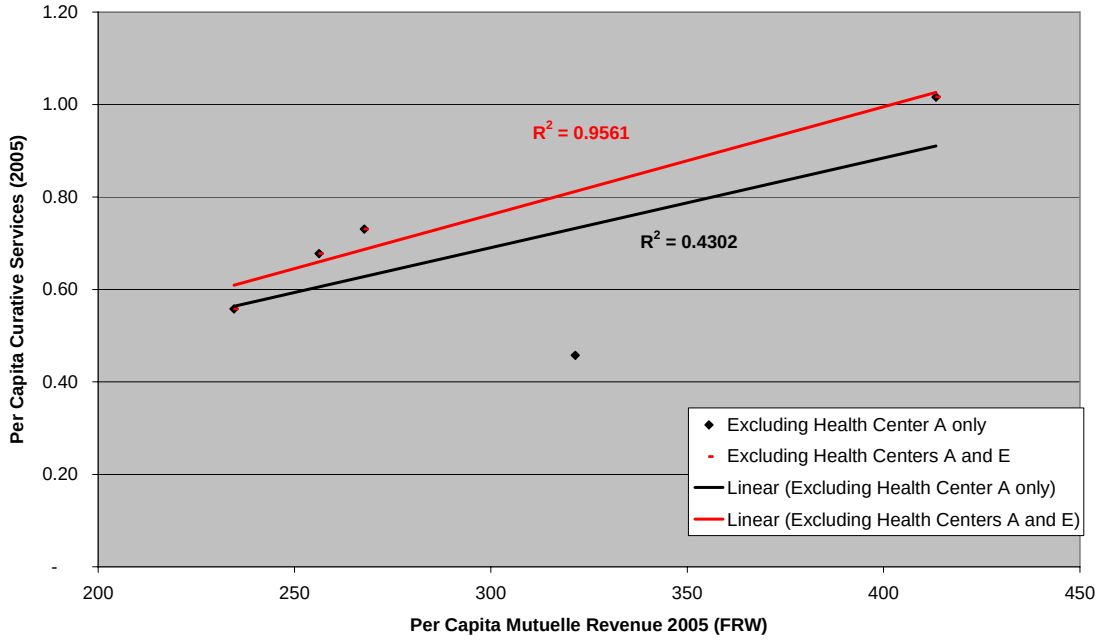


Figure 15: Average cost of a curative consultation as a function of the number of services

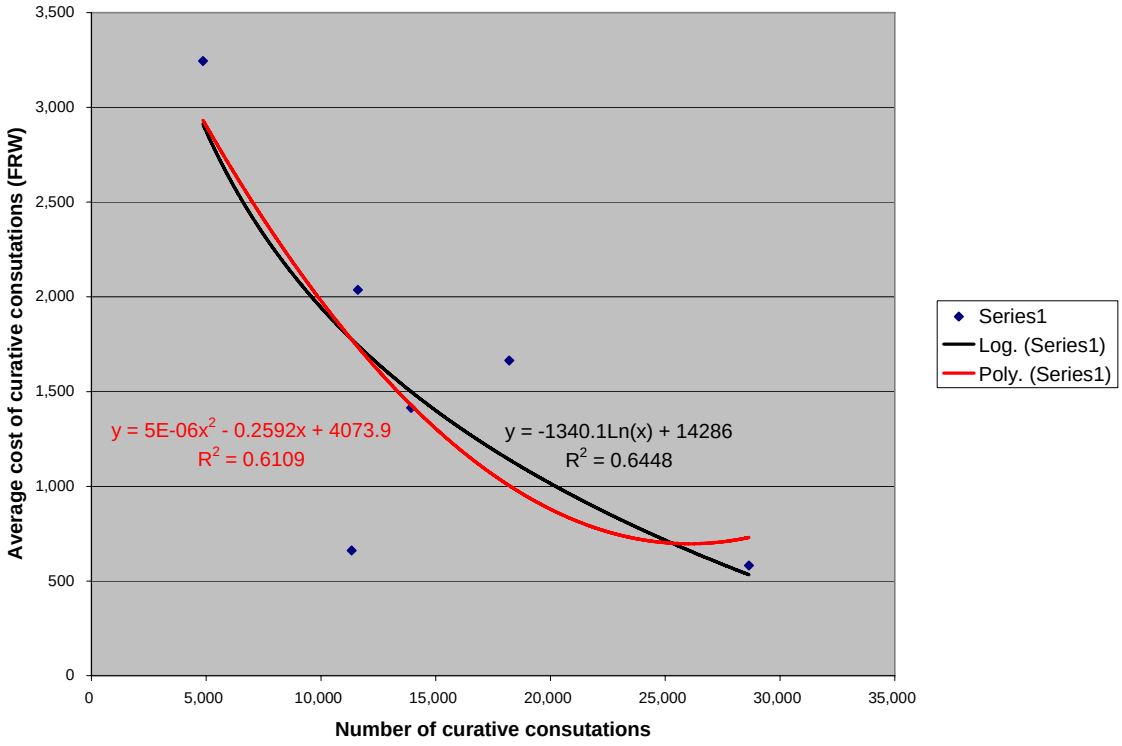
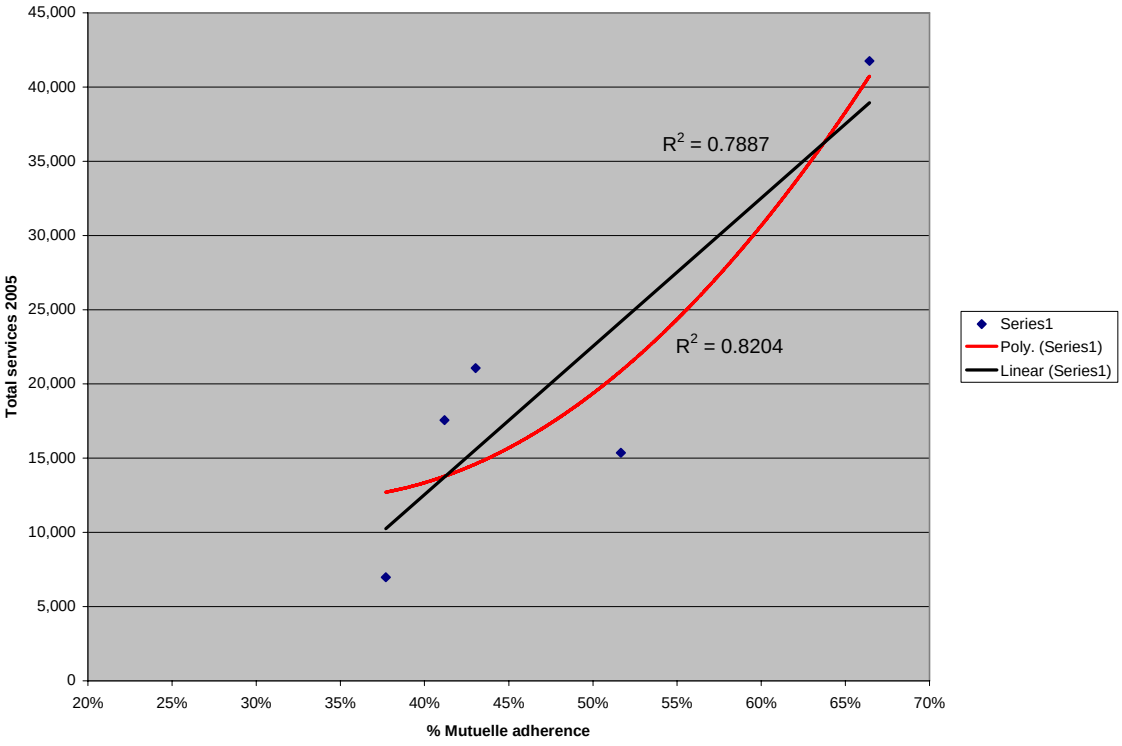


Figure 16: Percentage Mutuelle adherence and service utilization



A recently published study examined the impact of micro insurance (Mutuelles) on utilization and costs of services. It concluded that although service utilization increased significantly among the insured, that the average costs per visit declined. This was attributed to Mutuelle adherents not delaying treatment and coming earlier and thereby leading to less costly services (Schneider and Hanson, 2007). However, economies of scale can also be an important factor (see figure 15 and the Schneider article).

4.5h General Cost Recovery Observations

For the purpose of this study, capital outlay and medical equipment were annuitized and are incorporated within the costs of the health services and cost recovery figures. When capital outlay and medical equipment are excluded from cost recovery figures, those cost recovery figures generated by the study closely correlate with figures obtained by analyzing net surpluses of the health centers according to their monthly financial reports.

4.5i Cost recovery potential

Central government and donor subsidies are essential for health centers to operate and effectively recover costs. Figure 16 below illustrates the cost recovery potentials of all health centers in two scenarios: with full 2005 subsidy support and without 2005 subsidy support. When Capital Outlay and Equipment are not counted, all six health centers show positive balances (figure 17). Please see Annexes 5 and 6 for complete financial overviews of all health centers with and without counting Capital Outlay and Equipment.

Figure 17: Cost recovery potential with and without subsidies, with Capital Outlay and Equipment

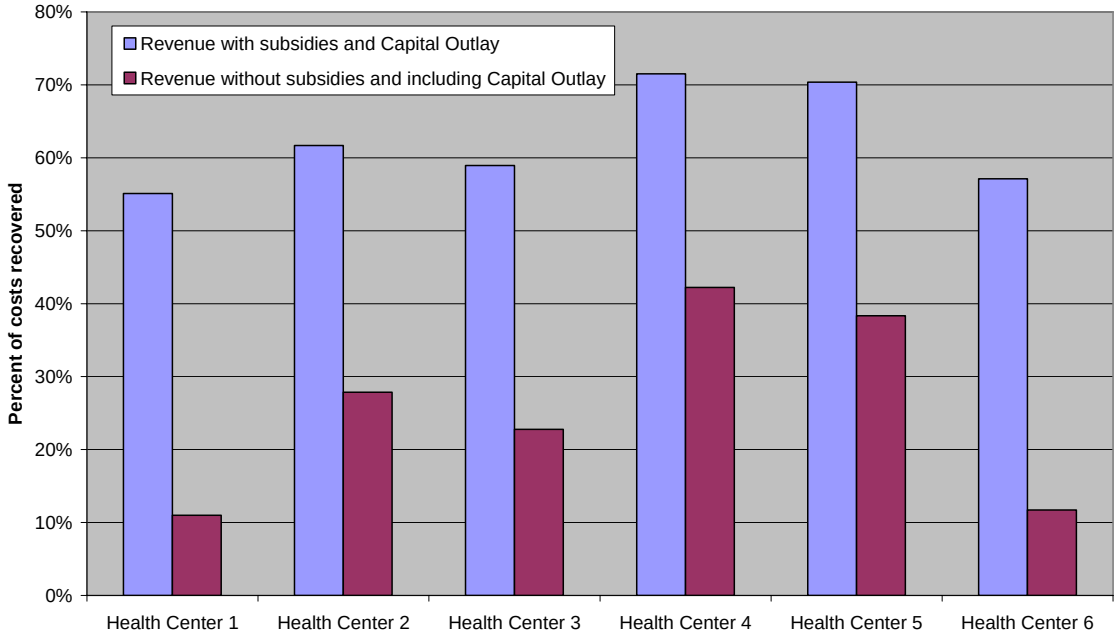
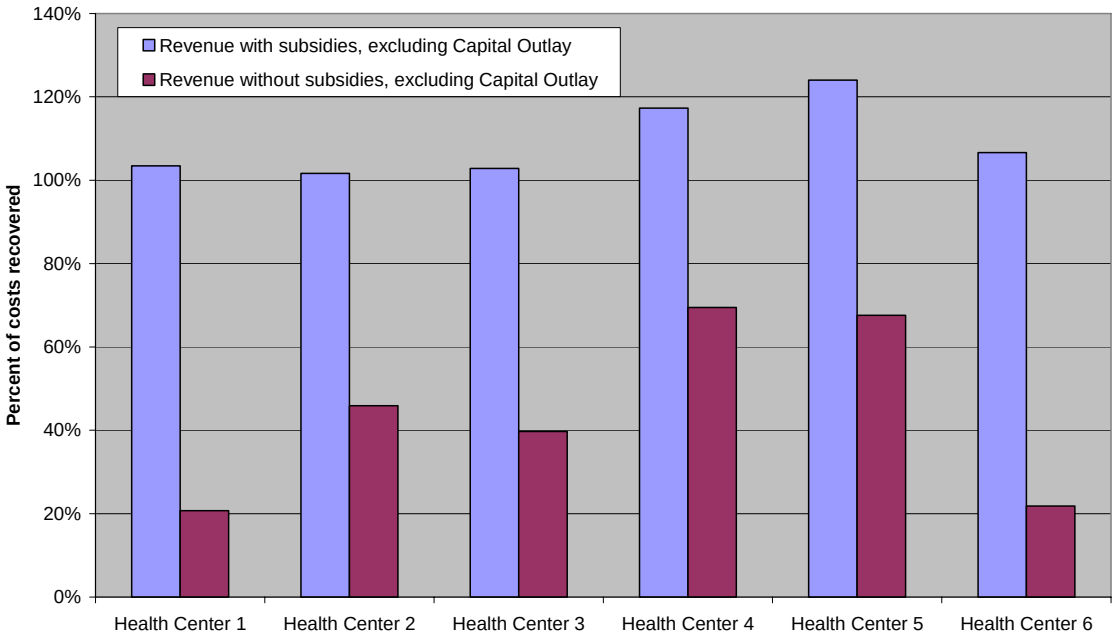


Figure 18: Cost recovery potential with and without subsidies, not counting Capital Outlay and Equipment



4.5j Factors affecting cost recovery

There is a **strong** correlation observed between cost recovery potential and per capita Mutuelle revenue (R^2 = 0.4302, or R^2 = 0.9561). There is **no** significant correlation between central government and donor subsidy per capita revenue and cost recovery potential. Finally, there is **no** significant correlation between services delivered per capita and cost recovery.

4.6 Public Health Statistics

Please see Annex 7 for an overview of general public health statistics for each health center.

Table 10: Utilization of Curative versus Preventive Services

HC	Tot Services	Curative Services	Preventive Services	Cur/Prev Ratio	Population	Tot Util/year	Cur Util/C/yr	Prev Util/C/yr
1	19,553	11,334	8,219	1.4	34,747	0.56	0.33	0.24
2	21,062	18,203	2,859	6.4	26,228	0.80	0.69	0.11
3	17,557	13,930	3,627	3.8	21,634	0.81	0.64	0.17
4	41,756	28,645	13,111	2.2	29,671	1.41	0.97	0.44
5	15,355	11,610	3,745	3.1	26,707	0.57	0.43	0.14
6	6,968	4,858	2,110	2.3	9,164	0.76	0.53	0.23
	122,250	88,579	33,671	2.6	148,151	0.83	0.60	0.23

There is a remarkable spread in the ratio of curative versus preventive services between these health centers. Utilization of services in general, both preventive and curative, is low. It will be interesting to see how the health financing reforms that have been implemented during 2006, both community based health insurance and performance-based financing, will have changed utilization of services.

5. DISCUSSION

5.1 Sensitivity Analysis

As reported in the results section, a variance analysis was completed to account for possible discrepancies between health center reports and GESIS statistics. The analysis yielded minor fluctuations in costs indicating that utilization and subsequent cost data is accurately reported regardless of possible GESIS inaccuracies.

5.2 Comparison of Costs of Health Services

The top ten health services observed in the six health centers include both curative and preventative services and range in weighted Average Total Costs from **FRW 298** to **FRW 7,714**. Three of the top ten conditions or services have an observed weighted Average Total cost greater than **FRW 2,000**. Additionally, some of the most commonly treated conditions including lower respiratory infections (child and adult) and bloody and non-bloody diarrhea (child and adult) have observed weighted Average Total Costs greater than **FRW 2,300**. In comparison, the weighted Average Total Costs of VCT and PMTCT are **FRW 2,593** and **FRW 3,279**, respectively. As illustrated in Figure 7, the cost of these common curative health services fluctuate much in the same manner as do HIV services. In table 11 and 12, the Average Total Costs for PMA and HIV services is given, including their weighted average, and double-weighted average Total Cost.

Table 11: Average Costs Including Capital Outlay and Equipment

Per Service	Average Total Cost (FRW)	Weighted Average Total Cost (FRW)	Double-weighted Average Total Cost (FRW)
Paquet Minimum des Activités[19]	2,337 (SD[20] 1,343)	2,051	1,871
VCT	3,318 (SD 970)	2,593	*
PMTCT	3,719 (SD 1,120)	3,279	*

The data in table 11 can be contrasted to the only available Rwanda costing data to date (Kagubare et al., 2005): in which FRW 2,098 was found as average cost for curative consultations, with an average variable cost of FRW 600 for preventive services (data for 2003 and 2004). In our costing study the Average Total Cost for curative consultations for 2005, including annuities for Capital Outlay and Equipment, is FRW 1,600 (SD

[19] Including HIV services
[20] The Standard Deviation (SD) is a measure of how widely values are dispersed from the average value.

985)[21] and without these annuities it is FRW 976 (SD 515).[22] However, the preventive services had not been included in the calculation of the average total costs, nor seem the subsidies and donations in kind to have been valued. Such donations and subsidies enter on both sides of the equation: on both the revenue and the cost side[23]. The 2005 Rwandan costing report, therefore, has not presented a balanced view of the Average Total Costs of health service provision at the health center level.

Table 12: Average Costs Excluding Capital Outlay and Equipment

Per Service	Average Total Cost (FRW)	Weighted Average Total Cost (FRW)	Double-weighted Average Total Cost (FRW)
Paquet Minimum des Activités	1,310 (SD 697)	1,321	1,105
VCT	1,960 (SD 350)	1,708	*
PMTCT	2,206 (SD 406)	2,042	*

Although HIV services indeed yield a higher cost than do other conditions or services (ANC or intestinal parasites, for instance), they are quite comparable in cost to other frequently observed conditions.

5.3 Observed Variance of Costs and Revenue

There are a range of costs and revenue for each health service. The variance in these estimated figures are due to a range of differences observed in health centers including local setting, catchment populations, utilization rates, case mixes, administrative costs, staffing configurations, differing quantities of donations and an apparent lack of adherence to standard operating procedures as set by the Ministry of Health. For instance, policies related to gate fees do not match income when using service utilization figures.[24]

> *Local setting, catchment population, utilization rates and case mix*. Estimates for costs and revenue are built upon the distribution of gross costs (operating costs, administrative personnel, etc) and gross revenue (government and donor subsidies, etc) proportional to the variable costs of each health service. Differing geographical and local settings (semi-urban vs. rural), catchment populations,

[21] The average weighted cost – which is the cost weighted for case mix – is FRW 1,172
[22] The average weighted cost – which is the cost weighted for case mix – is FRW 766
[23] A further difference is that in our study the average variable cost is 28% and average fixed costs is 72% (with Capital Outlay an Equipment annuities representing 43% of total costs, or 59% of fixed costs), whilst in the 2005 costing study Capital Outlay and Equipment were taken to be 25% of the fixed costs, whilst fixed costs were less than 40% of total costs. This means that the Capital Outlay and Equipment were taken to be about 9% of total costs, which is in contrast to the 43% we have taken).
[24] When contrasting actual revenue through Gate Fees, this does not match with actual stated mutuelle membership levels, nor does the revenue through mutuelle capitation payments match the % stated mutuelle membership.

prevalence rates, and incidence rates necessarily affect variations in total health utilization statistics and case mix of a particular health center. Also, a perceived better quality of services is an important driver of demand (Acharya and Cleland, 2000). Variations in utilization rates and case mixes mean that two health centers may not proportion equal amounts of costs and revenue to the same health service. For example, while Health Service X at Health Center A (based on the incidence rate) may be proportioned a large amount of fixed operating costs and revenue such as donor subsidy, the same service at Health Center B may be proportioned a significantly smaller amount of their fixed operating costs and donor subsidies to said service due to differences in utilization and case mix. Thus, we observe a variation on both the average cost and revenue calculated for Health Service X.

Differences in case mix are additionally responsible for the observed distinct groupings of types of health centers when total services is plotted against either weighted average or average unit cost per health service as illustrated in Figures 4 5 and 6. A case mix with a greater proportion of more costly health services led Health Center 4 appears to be more costly in Figure 6. Alternatively, a case mix with a greater proportion of less costly health services led Health Center 6 appears to be less costly in Figure 6. For instance, Health Center 4 has a much larger percentage of curative care conditions, which is represented by a new consultation/capita/year ratio of 1.02, whereas Health Center 6's ratio is 0.56.

Administrative costs. Administrative costs include any non-medical related supplies or materials, building maintenance costs, rent, utilities, and administrative personnel, etc. expenses either incurred directly by the health center or subsidized by the GOR or a donor agency. Those costs covered by in-kind subsidies are also considered revenue. These sources of costs and revenue vary by health center and have a large impact on the cost and revenue collected for each health service. Fluctuations in these costs and revenue not proportional to utilization rates and case mix account as well for variations in costs and revenue calculated for all health services.

Staffing configurations. As seen in Annexes 5 and 6, one of the major drivers of costs is labor. Variations in staffing patterns and, more specifically, the efficiency of those patterns produce variations in the average cost per health service per health center. For example, although Health Center D has approximately 56% more staff than Health Center F, it is able to produce approximately 325% more curative services with a staffing configuration that more closely mimics the ideal staffing scenario.

Donor subsidies. Subsidies are major drivers of both cost and revenue as they are considered both. Each health center received similar quantities of in-kind and/or cash donations without any relationship to the catchment population, disease incidence rates or activity level. Therefore, both costs and revenue vary greatly due to similar subsidy contribution, but varied quantity of services delivered.

Lack of adherence to standard operating procedures. Revenue figures were varied due to a lack of adherence by staff to standard operating procedures related to charging of fees per service for instance *Ticket Moderateur (gate fee)*, consultation fees, laboratory test fees, and surgery fees. Attempts at modeling based on policy yielded results not in-line with actual 2005 figures necessitating the input of actual revenues and abandoning the use of the model as it was not possible to create any accurate model. Without staff adherence to standard procedures for charging fees, revenue generated from fees varied greatly by health center and did not correspond to utilization statistics.

In order to reconcile these factors affecting variance among the average costs and revenue per health service per health center, the study utilizes two types of averages; non-weighted and (double) weighted averages as presented in the results section and Annexes.

As well, the study, when pertinent, grouped health centers by observed cost and service level type when analyzing and presenting results. These groupings allow for the development of formulas that can be used to estimate the cost of a particular health service or the average health service in the context of a given number of total services provided per year.

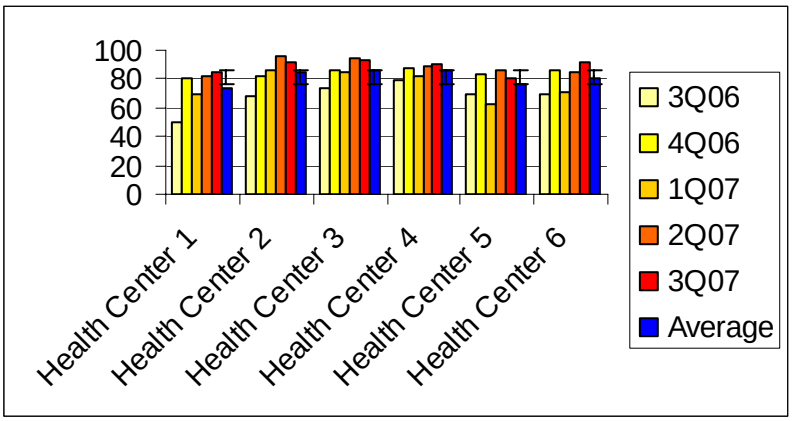
$$y = 6E\text{-}06x2 - 0.4166x + 7371.3$$

Where x = total services delivered in a given year (preventative and curative), and y = Average Total Cost of a Health Service in FRW.

This production coefficient presumes that producers are all on the same Average Total Cost curve. The assumptions made are that the general level of efficiency, input prices, case mix, volume of services and quality of output and annuity for capital equipment and outlay are the same. If any of these variables is dissimilar, the Health Centers will be operating on different curves (Jacobs, 1997). However, whereas input prices, capital equipment and outlay are similar,[25] case mix, number and type of staffing and general efficiency differs. Differences in case mix, volume of services produced and general efficiency explain why the least costly provider of services, the health center with the lowest average cost, has the highest weighted average cost per service. Quality of care as measured through an elaborate instrument measuring 185 variables across 13 services has, between July 2006 and June 2007, bar one health center, not shown any significant variation between these six health centers.[26]

[25] The same Annuity for Capital Outlay and Equipment were used.
[26] This Quality Supervisory tool was not yet implemented at the time of the costing study; therefore no data are available for 2005.

Table 13: Quarterly Quality Scores of the Six Health Centers, 2006-2007



In the above graph, the average quality of services in the six health centers for which the costing study was carried out, the average quality performance is 81.3%, with a 5.3% standard deviation. Only Byumba HC falls outside this standard deviation with an average quality of 73.5%.

Care has to be taken when using these production coefficients. Whilst the data underlying these calculations are accurate, and assumptions have been made overt, the six health centers will be on different Average Total Cost curves and hence a 'best fit line' between these averages should be interpreted as indicative rather than precise.

5.4 Utilization of Health services, Staff Efficiency and Average Cost

As illustrated in Figure 4, the non-weighted average cost per health service decreases as the total number of health services delivered by the health center increases. This is equally true for the cost of HIV services as a function of total number of services delivered. Figure 7 illustrates that a major driver in the cost of delivering HIV services (VCT and PMTCT) is general utilization of health services.

Assuming a health center maintains a consistent staffing pattern and does not substantially increase general operating costs, increased efficiency on part of the staff, when quality remains equal, leads to more cost-effective health services *if* utilization increases. Once full capacity is reached, additional staff will have to be added, changing average costs. The results of the study indicate that demand as well has various, observable drivers.

5.5 Drivers of Demand for Health Services

Many factors influence demand for and utilization of health services. There are financial and geographic barriers to access services. There is opportunity cost of time to seek care or to take care for a sick relative; there are cultural beliefs and customs. A perceived high quality of services will increase demand. Also, Government can institute laws, for instance related to family planning or institutional deliveries, which might form an

incentive for using these services. A known powerful demand side incentive (or disincentive) is financial cost of services to the user.

This study observed a strong correlation between adherence to the *Mutuelle* insurance program and per capita utilization of health services. As illustrated in Figures 14 and 15, as adherence to the *Mutuelle* Program (as observed by an increase in annual per capita program premium revenue) increases, so does service utilization. This, of course, logically follows as the obligatory enrollment in an insurance program will, given a population educated on entitlements of enrollment, encourage service utilization.

Another factor likely to indirectly influencing demand for health services is the total amount of subsidies. As cited in the results section, subsidized support is essential to cost recovery, which is in turn, essential to providing services. Although, the study yielded no significant results for this relationship, subsidies provide access to essential drugs, laboratory tests and other medical supplies and ensure staff is paid; an infrastructure to allow quality services that would otherwise not be achieved.

As subsidy levels tend to be similar per health center regardless of utilization and catchment population statistics (rather than proportional to these figures), **no** correlation was observed.

5.6 Improving Staff Efficiency

As previously noted, one explanation for why the (non-weighted) average cost of services decreases as total number of services increases is an increase in staff efficiency. There were important results pertaining to actual versus ideal staffing patterns. Figure 9 illustrates the difference between actual and ideal staffing patterns. There are large discrepancies between the two scenarios observed for all health centers. Additionally, Figure 11 suggests that significant portions of average staff are *indirect*. This data suggests a lack of efficient utilization of staff observed at all health centers, which largely employ extra A2 level nurses who fill gaps created by lack of lower cadre (and pay) staff. This lack of efficient staff utilization is costly. Figure 12 indicates actual and ideal number of services per hour per staff member. Any negative deviation from ideal indicates poor use of staff time (and the associated costs) whereas any positive deviation from the ideal indicates that staff is not able to spend appropriate time with patients, affecting quality levels assumed in the SPW. Therefore, additional measures to improve staff efficiency will lower the average cost of services.

5.7 Quality

Staff adhering to treatment protocols prescribed by the service practice worksheets is assumed to be providing services that are reasonably cost effective. The output of the health centers is real: the approximate number of services per category rendered. However, the tool cannot verify whether staff actually spent on average 30 minutes with the client or 10 minutes. Taking some figures at face value could lead to a false sense of security. Observations from the field do suggest that, in the real world, huge inefficiencies exist and that quality of services, frequently, is below acceptable standards. Data from this study prove that the number of provider to patient contacts per hour is

seriously under the norm in five of the six health centers studied (see tables 7 and 8), indicating that there is scope to increase substantially production with the current level of fixed costs. Performance-based financing is expected to introduce supply side incentives to encourage more efficient and effective use of resources. The quality assurance component will make objective the quality as measured through a quarterly checklist that will yield a cumulative figure for quality of care in the health institution (see table 12). It is hoped that monies earned through PBF will stimulate the health center management to contract additional human resources where needed, and will pay for the investments necessary to bring quality standards up to prevailing norms.

Norms related to recommended daily Provider: Patient Ratio's at the Rwandan Health Center level stipulate a maximum daily ratio of 1:40 for an A1 nurse and 1:25 for an A2 nurse (MOH, 2006c). As A1 nurses are very scarce, actually all work of A1 nurses are currently done by A2 nurses (such as curative consultations and the like), and a 1:40 ratio can be taken. The above ratios were based on 216 provider workdays, whereas in our study, based on real availability of staff (including sick days, study days, holidays and the like), the average number of provider days was between 207 and 211 days/year/staff. Therefore, about 5 patients per hour per A2 nurse is the national norm. Tables 7 and 8 present this situation: using existing staffing patterns and assuming 80% direct patient time, and modeling to the national norm of 5 patient-provider contacts per hour, would increase the number of services from an average of 0.8 to 1.8 per inhabitant per year.

5.8 Background of the Project and Recent Developments

The purpose of the HIV performance-based financing contract was to 'graduate' HIV sites supported by USG collaborating agencies, steadily from input financing into a mix of input and output financing. The 'graduation' although initially low-scale (7 sites graduated by September 2006), was supposed to accelerate to 35 sites by September 2007, 70 sites by September 2008 and 100 sites – virtually all current USG supported HIV sites- by September 2009. In MSH's budget, the costs of providing a mix of PMTCT, VCT and OI services, taken from an average cost for three USG collaborating agencies was added, approximately USD 31,000 per 'mature' site per year.[27] However, the exact way how this ought to be done, for instance through what model or what administrative arrangements, what the mix should be between input and output financing or what indicators – with what relative values- ought to be purchased had at the time of the contract award, or the onset of this costing study - not yet been defined. Although fairly accurate budgetary information was available on the costs of VCT, PMTCT, OI and ARV services supported by collaborating agencies,[28] little was known on the costs related to the provision of such services by providers.

These health service provider costs are important when considering sustainability of health services or, such as in our case, attempting to finance part of the costs related to HIV services through output based payments using a case-based reimbursement

[27] The average cost to a USG collaborating agency, for a 'mature site', to "provide" PMTCT, VCT, BHCS and TB/HIV services were $38, 500 per year. The "provision" meant technical assistance, quality assurance, ongoing training and reimbursement of minor expenditures. This varied between $35, 500 and $43,000. These costs included all support costs of the agencies.

[28] Budgeted Costs were available through the Collaborating Agency's approved budgets.

mechanism. Existing PBF pilot schemes in Rwanda had two objectives for performance-based financing, the first to stimulate performance, the second to infuse much-needed additional resources at the health facility level. The unit value for output payments had not previously been calculated as compared to the actual cost to the health service provider of producing the service/indicator. Basically, up to the design of the costing study, bonus payments for PBF indicators/health services had been determined by modeling available budget and quantity of services provided. Monies earned through PBF would enter the health center bank account, and therefore would be available to the health center management to spend where necessary, i.e. rehabilitation, purchase of equipment, drugs, medical consumables, paying additional staff or staff bonuses for existing staff. The idea of churning part of the recurrent costs of supplying HIV services through output payments led to a new point of view and to the desirability of knowing more about the provider costs to produce HIV services relative to other primary health services. The requirements were therefore established for carrying out a fairly accurate micro-costing of health services (also called 'bottom-up' or 'activity-based' costing).

Between the conception of this study, the field work and the actual data-analysis and writing up this report, quite a lot of time lapsed. There were multiple reasons for this. First, data analysis was not carried out directly after the fieldwork and the treatment-practice workshop in April and May 2006. Therefore, towards the end of 2006, a decision was made to bring in a second consultant to work on finalizing the collection of some missing data and to complete the data entry and data analysis. Between the conception of the study, the fieldwork and the data analysis, the context also changed. The national performance-based financing model for health centers and district hospitals was finalized (Rusa and Fritsche, 2007, Schneidman and Rusa, 2006). After completion of the new PBF model for health centers, and making explicit the unit fees for the primary health care indicators – that the GOR would be purchasing – work was completed on the HIV performance-based financing indicators, this included their 'indexation' i.e. their relative values (see Annex 10 for indices and real values). The 'graduation concept' was abandoned towards June/July 2006.[29] Reasons for changing the 'graduation' strategy was a request from USAID, as USG CA's who had started their work in these sites wanted to finish the work they started, also there was an explicit request from the MOH to make CA's responsible for both the input and output payments in their sites, and to have them relocated to defined districts, rather than working through fragmented networks throughout the entire country. The latter led to a new request for applications (RFA) and the harmonization of CA's across large parts of Rwanda, a process that is ongoing at the time of writing (September 2007).

As the 'graduation' concept was abandoned, MSH proposed to set up a system of 'bonus payments' only, akin to the purpose of the new PBF schemes in Rwanda. These 'bonus payments' presume that input financing continue to support health services, but that these 'bonus payments' would be added to the pre-existing financing pathways, with as aim to stimulate the effectiveness and efficiency of health services, including HIV services.

Although the various input-financing streams in health centers did overall not lead to financial loss, confirming that – overall – the costs and the revenues were in balance, it

[29] See above for an explanation of the graduation concept

was clear that corners were cut; resources for rehabilitation and purchase of essential equipment, contracting additional staff and money to motivate staff (through bonus payments) was missing. These 'bonus payments' would inject much needed additional financing in the health centers.

The new national PBF model ties earnings for HIV indicators to the percentage 'quality performance' obtained using a quarterly quality supervisory checklist.[30] Payments for performance are based on the quantity of outputs achieved (on a case-reimbursement basis) conditional on the quality of services rendered. The outputs are measured monthly while the quality is measured quarterly through the use of an elaborate supervisory checklist. Health centers staff can increase their performance, and hence their earnings, by increasing the quantity of outputs, increasing the quality of services delivered (as measured by an elaborate instrument measuring quality across 13 services and 185 variables), or both. When both quantity and quality increase earnings will be highest.

The formula is $Earnings_{HC} = Quantity * \% \ Quality$

In which '$Earnings_{HC}$' is the consolidated quarterly health center invoice (for either PMA[31] or HIV), '*Quantity*' stands for the quarterly provisory health center invoice (the sum of all indicators, either PMA or HIV, multiplied with their unit fees), and '*% Quality*' stands for the consolidated score—expressed as a percentage—obtained from the quarterly quality supervisory checklist.

Modeling the absolute value of the HIV PBF indicators took place between June and September 2006. The forecasting model was based on the TRAC 2005 databases, a specific modeling exercise for Gicumbi district HIV sites, experience gained related to growth patterns for similar indicators in a Rwandan MAP/WB funded HIV PBF project, and an approximate budget of USD 11,000 per 'site' per year.[32] The figure of USD 11,000 was chosen as this was planned as the approximate budget for output financing in our contract and in addition it was in line with budgets used by MAP/WB in their pilot HIV PBF project. Currently and as of April 2007, the project has 85 purchase contracts, out of which 79 are purchase contracts for HIV PBF indicators, the remainder are for performance-based financing schemes at district hospitals.

The HIV PBF project has, therefore, moved away from putting recurrent budget through output based payments to a system of bonus-payments for service outputs; for both productivity and quality of services, whilst the CA's supporting these HIV services with input financing and technical support remained unchanged. However, the importance of the outcomes of this costing study remains strong, if not more important now than at the outset of this study. First, USG collaborating agencies (ICAP, CRS, IHI, FHI and

[30] This quarterly quality supervisory checklist contains 13 services, with 185 variables, each with a weighting. A cumulative score is extracted from this. This quarterly checklist was adapted from a similar tool that had been utilized in the Cordaid 'Cyangugu' PBF pilot model.
[31] PMA = Paquet Minimum des Activités; Basic Package of Health Services
[32] This budget was for 'bonuses' only, and was meant to infuse monies into the health center bank accounts for the health center management to decide how to spend, for instance on additional human resources, equipment, staff bonuses or a mix of these. Usually, about 60% of the earnings through these kinds of bonuses were earmarked to be spent on non-salary recurrent costs and 40% on staff bonuses.

EGPAF) are supposed to gradually take over the purchase contracts that MSH has written on their behalf, therefore all the aforementioned study objectives, i.e. related to the real cost of HIV services to the providers, are important. Second, during 2006, administrative reforms have been implemented, making the districts responsible for sector programs and their financing; there is an acute need for more knowledge on costs of providing services, proof of which is that Twubakane, an IntraHealth and partners project, has carried out a similar but larger-scale costing study in the health sector which is planned to be finalized in the third quarter of 2007.[33] Third, the Mutuelles have been rolled-out nationwide during 2006, paying providers on a cost-reimbursement basis. There are few solid cost-data in Rwanda that inform health planners, policymakers or Mutuelles on the real cost of services (Kagubare et al., 2005). Finally, and complementing the above: there is a general dearth of information related to unit costs in health service provision in Rwanda, information which, in the current context of rapid and profound health financing reforms, is sourly needed. Information on these unit costs is needed when providers are reimbursed based on services rendered and or when determining to what extent varying service mix volumes impact on costs.

6. CONCLUSIONS

The study had three main objectives: first, to study the unit costs for PMTCT, VCT, and OI services for 2005 and to compare, for 2005, the unit costs of HIV services to unit costs of each basic health service in the basic health service package in the same health centers; second, to make recommendations on various health financing mechanisms for HIV services using performance-based financing/performance-based contracting; and finally, to make recommendations on fees and revenues in a representative sample of Rwandan health centers. A provider perspective was utilized.

The study found that, for 2005, the average cost, reported in Rwandan Francs,[34] of a general health service ranges from **FRW 48** to **FRW 7,934** with an average of **FRW 2,337 (SD 1,343)**. Additionally, the average cost of VCT is **FRW 3,318 (SD 970, min 1,890 and max 4,717)**, whilst the average cost of PMTCT services is **FRW 3,719 (SD 1,120, min 2,052 and max 5,439)**. Unit costs for IO services could not be calculated as these were integrated in other services and not provided separately. The annuity for Capital Outlay and Equipment represented 43% of Total Costs, or 59% of Fixed Costs. The Total Costs, on average, for 2005 was FRW 37,125,767 (SD 2,887,604) or FRW 1,876 (SD 1,034) per inhabitant per year. When removing the large annuities for Capital Outlay and Equipment, we arrive at a cost of FRW 1,059 (SD 538) per inhabitant per year.

Average and weighted average costs[35] have been determined for VCT and PMTCT services. Implications for the HIV PBF project, and for USAID, are as follows:

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[33] Twubakane used a step-down costing methodology. Results of the Gicumbi CORE study and the Twubakane costing study should be complementary, and a joint presentation of results for the MOH is planned.

[34] The 2005 exchange rate for the USD was 1 USD = 560 FRW

[35] Weighted average costs are average costs weighted for case-mix.

A first conclusion is that these are in line with those of other common services and conditions, which bodes well when contemplating horizontal integration into the basic health service package, and for financial sustainability. These services, as this study points out, are not costlier to provide than to treat a common condition such as bloody diarrhea in a child or treating a case of lower respiratory tract infection. This implies that when trained and well-motivated staff is available, tests and consumable materials are supplied, and some funds necessary for some HIV specific recurrent expenditures (such as bringing blood samples to the national reference laboratory) are provided, when complemented by adequate supportive supervision that, in that case, costs are affordable.

Second, the bonus fee determined for VCT and PMTCT services, of FRW 500 and FRW 250 ($0.91 and $0.46 in 2007 exchange rates) respectively, bear **no** relationship to the actual cost to the provider of providing these services – not to the economic costs from a provider perspective, nor to the financial costs to the provider when omitting Capital Outlay and Equipment annuities.

Even when omitting Capital Outlay and Equipment annuities, an act not considered wise from a financial sustainability point of view when paying providers through prospective payment mechanisms, the following figures emerge. From the non-weighted average cost for VCT services (FRW 1,960, SD 350 range 1,491 - 2,252) and the non-weighted PMTCT services (FRW 2,205, SD 406 range 1,613 - 2,833), FRW 1,227 for tests and laboratory materials needs to be subtracted, as these are donated. Subtracting this material, donated by other sources, such as the CAs (laboratory material) or supplied from central level (VCT tests), leaves a cost of FRW 733 (range 264 – 1,025) for VCT services and FRW 978 (range 386 - 1,606) for PMTCT services.

If USAID contemplates purchasing VCT and PMTCT services through an output-based financing scheme, it would need to pay a fair price for these services. A decision to pay a fair price for these services would, however, need to take into account fees paid for other PBF indicators, namely the basic package of health care related ones. There are, therefore, limits to what USAID could pay for such services in order not to destabilize the incentive schemes for other essential services such as antenatal care, institutional deliveries and vaccinations for children.

The bottom line is that the Rwandan national performance-based financing model is not suitable to be considered as ‘case-based reimbursement’ health financing, but rather as a ‘case-based reimbursement’ look-alike. From this perspective it is best to talk about a bonus or incentive system. This finding has **serious** implications for the USG policy related to financing HIV services through the Rwandan PBF system. Namely: the findings imply that financing of HIV services can never be entirely ‘pushed through’ a PBF system, but that a mix of financing pathways would need to be used: both input and output financing should be combined judiciously.

OI services could not be calculated as such services were embedded in other services and could not be disaggregated. ARV services could not be calculated because, for the study period, ARV services had only been available at the Hospital. Information on the cost of

ARV therapy in low economic development countries has been described comprehensively elsewhere (Kahn et al., 2005).

The third conclusion is that paying a performance bonus for HIV services is an attractive proposition as seen from different angles; for the health facility as its income increases and management can use the additional income for increasing staff motivation (individual bonus payments) or for improving structural quality. For USG, as the same amount of input financing (the cost of supporting CAs 'maintenance' of 'mature sites') leads to a much better quantitative result,[36] therefore leading to a higher efficiency of PEPFAR monies because PEPFAR itself is a results and output oriented program. For the health sector and society as a whole, an increased service production brings lowered Average Total Costs as health centers in general are inefficient and underutilized (as documented by this study).

There is considerable scope to increase services with the same amount of fixed costs, and after efficiency gains have led to a maximum production, adding additional human resources would allow for a wide range of increase in levels of outputs with marginal costs below average total costs. This statement holds especially true when a very high proportion of the total costs are fixed costs, which is the case in our study (72%), and has a very high Capital Outlay and Equipment component (59% of Fixed Costs). Average Total Costs will continue to drop for a significantly longer time during an increase in production of services in such situations with a high fixed cost production component (Jacobs, 1997).

To illustrate the above: USG paid $10,000 per year during 2005/2006 for *maintenance* of a 'mature VCT site', which produced 3,008 tests for Mukono, Rutare, Rwesero and Munyinya during 2005. The cost to USG is thus (4*10,000)/3,008 = $13.30 per test, whereas the cost to the provider is $5.26 excluding the HIV test.[37] For PMTCT, the cost to the donor is (4*20,000)/3765 = $21.2 per client, whereas the cost to the provider is $5.98 excluding the HIV test. The CA's 2005/2006 costs to support a 'mature site' does not include the cost of HIV tests, but does include the cost of medical consumables.

PBF is important from various points of view. For instance, the four health centers mentioned above have been contracted by the USG for the purchase of HIV PBF indicators. During the period October 2006 to September 2007 (12 months), these four health facilities produced 11,264 VCT tests.[38] All things remaining equal, the USG would therefore pay the CA (4*$10,000) for 11,264 tests and so one VCT test would only cost $4.47 ((4*10,000 + 11,264*$0.92)/11,264) for the USG. So in fact, the USG is paying only $4.47 per VCT test in Gicumbi district in 2007, and making a **saving of $8.83 on each VCT test (!).**

Let us assume that, in the absence of PBF, the 'natural growth' of VCT tests would be 50%, result of various efforts from the CA and health authorities. This situation would

[36] In nine months, from October 2006 to July 2007, the average monthly number of VCT tests in Gicumbi districts (9 sites) has increased by 155%.
[37] An HIV test costs FRW 371, or $0.67, these are donated to the health centers from central level, and these are not included in the IHI budgets.
[38] Based on real data extracted from the PBF data base at www.pbfrwanda.org.rw on 30 October 2007

lead to a 2007 VCT test cost to the USG of $8.87 (in the absence of PBF) but to still a **saving of $4.43 per VCT test** because PBF has been added.

*In fact, the" natural growth" in VCT tests (natural in the sense of in absence of PBF) would need to be **197%** (8,949 tests) to reach the same level of cost-efficiency for USG VCT activities in Gicumbi as the level achieved through PBF. See table below.*

Table 14: Costs of VCT tests compared between 2005 and 2007 Gicumbi Health Facilities

	VCT2005	VCT2007_50%natural	VCT2007_197%natural	VCT2007_PBF
Tests	3008	4512	8949	11264
Cost USG	$40,000	$40,000	$40,000	$40,000
Cost PBF	$0	$0	$0	$10,363
CostTest	$13.30	$8.87	$4.47	$4.47

The total cost to the provider would go up by the marginal costs of production (which is the average variable costs, i.e. the test and laboratory materials used) for each additional test. These supplies are donated to the health center and are not a direct cost to the provider. Serious inefficiencies in existing staff utilization would allow shifting human resources to the production of additional services including HIV services. Fixed costs would remain the same for a considerable range, whilst when changing their 'technology of production', for instance through hiring additional staff to shift trained HR towards VCT testing after reaching maximum staff utilization, would also lead to an increase in the number of services produced in the health center overall and thus to a decreasing average cost for producing VCT testing for that health facility. These costs would continue dropping over a prolonged period of time as fixed costs are 72% of total costs when counting Capital Outlay and Equipment, and 51% without these.

Examining fees and revenues through this study, leads to the following conclusions: first, when contemplating cost and revenues when not taking into account Capital Outlay and Equipment, we see that all health centers have a positive balance sheet. This means that, considering the current funding levels, that the funding (i.e. the various funding mechanisms such as income from Mutuelles through capitation payments, out-of-pocket payments by clients, subsidies through Government and development partners offset the costs to the provider. The CORE-PLUS R figures for costs and revenues closely match the real balance sheets as reported through the GESIS, confirming the general accuracy of this micro-costing tool and the financial data reported through the GESIS.

However, when taking into account Capital Outlay and Equipment, which is standard good practice in cost-reimbursement of providers, we see that all health centers are in the red.

A second conclusion related to this matter is that five out of six health centers have demonstrated serious inefficiencies; the current number of services per inhabitant per year, all services combined, is 0.8, whilst the potential number of services per inhabitant per year, using exactly the existing human resources is 1.8. Introducing supply-side incentives through PBF, although it will lead to an increase of costs of services, will lead

to a decrease in the average total costs as fixed costs will continue to drop whilst production is increased. Modeling normative costs through one of the CORE-PLUS R tools shows a decrease of average total cost in all six health centers when increasing services by 5%. Marginal costs in all six health centers are below marginal revenue therefore technical efficiency will increase when production is increased.

A third conclusion is that income through Mutuelles is important, on average 24% of revenue, and this study has demonstrated a strong positive correlation between health center mutuelle income per capita and service utilization. Decreasing the financial barrier to access services, in combination with supply-side incentives through PBF are mutually reinforcing and compatible health financing methods in Rwanda and confirm the correct technical foundations of the health strategic plan. However, this study has also documented that actual income through Mutuelle adherence does not match stated % of Mutuelle adherence, therefore quite significant financial benefits could be gained by ensuring that income through Mutuelles would match the % stated Mutuelle adherence.

Annex 1: Health Center Survey

Centre de Santé Questionnaire

1. Quel est le pourcentage de la population a été couvert par mutuelle en 2005?

2. Quel est le pourcentage de la population a été couverte par FARG, Gacaca, Agri ou/et Secteur informel en 2005?

3. Quel est le pourcentage de la population a été indigène en 2005?

4. Quel est le pourcentage de la population qui paye le prix fort pour des services de santé?

5. Quel était le montant total (FRW) reçu en tant qu'honoraires d'inscription de mutuelle en 2005?

6. Quel est le pourcentage de visite qui se produit pendant les heures régulières de clinique?

7. Quel est le ratio de bénéfice par rapport aux salaires (les bénéfices représentant en moyenne le salaire de base)?

8. Combien heure par jour ce Centre de Santé est ouvert?

9. Combien de jour par semaine ce Centre de Santé est ouvert?

10. Combien heure par poste (**normal working shift**) par jour?

11. Combien de jour par année ce Centre de Santé est ouvert?

    a. Combien de jours fériés y a-t-il?

    b. Est-ce que ce Centre de Santé travaille pendant les jours fériés?

12. Quel est le nombre moyen de jours de vacance pris par le personnel chaque année?

13. Quel est le nombre moyen de jour de congé de maladies pris par le personnel chaque année?

14. Quel est le nombre moyen de jour passé par le staff en formation chaque année?

15. Quelles sont les frais de transport pour les médicaments achetés (en pourcentage)?

16. Quelles sont les frais de transport pour les fournitures achetées (en pourcentage)?

17. Quel est le bénéfice (majoration) pour les médicaments (en pourcentage)?

18. Quel est le bénéfice (majoration) pour les consommables médicaux (en pourcentage)?

19. Quel est le bénéfice (majoration) pour les tests de laboratoire (en pourcentage)?

20. Veuillez énumérer tout le personnel du centre de santé aussi bien que l'information demandée. NOTE : % directe est le pourcentage du temps que l'employé passe dans l'interaction directe avec les patients. Garde c'est le montant payé pour les heures de garde.

    - Nom et prénom, Titre, Cadre, Qui paye ces fonds ?, % directe, Salaire mensuelle, Garde, Prime d'encouragement, Prime du Gouvernement.

21. Quels consultations et/au types de tests de laboratoire et chirurgie qui sont offerts par votre centre de santé?

Consultations	***Oui/Non***
Infirmier	
Infirmier / nuit, weekend et jours fériés	
CPN	
PF	
Nutritionnelle	
Autre 1	
Autre 2	
Autre 3	
Hospitalisation	***Oui/Non***
Salle commune	
Chambre	
Laboratoire	***Oui/Non***
Albuminurie	
ALAT, ASAT	
CD4	
Crachat BK	
Créatinine	
Frottis vaginal a frais	
Frottis vaginal a gram	
Globules blancs (WBC)	
Glycosurie	
Gouttes Epaisses (GE)	
Gram	
Hb, Ht CS	
Hb, Ht Hôpital	
Lymphocytes total	
Plaquettes	
RPR	
Sediment	
Selles	
Test de grossesse	
Urine	
V.S. (vitesse de sédimentation)	
VIH teste indirecte	

WBC (GB) Hôpital	
Chirurgie	***Oui/Non***
Injection IM/IV	
Actes de perfusion	
Pansement simple	
Pansement compliqué	
Frein linguale	
Seringage	
Suture simple	
Suture compliqué	
Ablation des fils	
Incision d'abcès	
Extraction simple d'un corps étranger	
Extraction d'une dent	
Curage	
Curetage	
Maternité	***Oui/Non***
Accouchement après 3 CPN	
Accouchement eutocique sans épis	
Accouchement eutocique avec épis	
Accouchement dystocique	

Annex 2: Non-weighted Cost for all Health Services.

All values presented in Rwandan Franc (FRW).

Consultations Cost per Service (FRW)	Byumba Dis	Mukono CS	Munyinya CS	Rushaki CS	Rutare CS	Rwesero CS
Under-five Clinic	7,903	4,207	10,869	6,044	4,211	14,368
Fièvre origine inconnue & paludisme présumé adulte	920	1,046	1,111	612	1,489	2,041
IAVRS enfant	873	982	956	513	1,087	1,416
IAVRS adulte	720	771	775	410	886	1,159
Consultation Prénatal (CPN)	424	515	385	243	620	862
VCT	2,644	3,786	3,467	1,890	3,406	4,717
Parasitose intestinale enfant	499	392	430	217	547	702
Parasitose intestinale adulte	446	342	389	193	492	630
Fièvre origine inconnue & paludisme présumé enfant	1,186	1,436	1,449	802	1,826	2,503
IAVRI enfant	2,557	3,115	2,956	1,752	3,136	4,200
Paludisme confirmé enfant	1,956	2,488	2,432	1,384	2,843	3,805
Paludisme confirmé adulte	1,560	1,915	1,891	1,096	2,278	3,119
Borréliose confirmée enfant	391	435	469	409	550	426
Borréliose confirmée adulte	700	775	787	743	2,943	759
IAVRI adulte	3,112	4,151	3,889	2,207	3,956	5,312
Diarrhée sanglante enfant	2,474	3,485	3,205	1,772	3,397	4,596
Diarrhée sanglante adulte	2,585	3,692	3,393	1,877	3,571	4,835
Diarrhée non sanglante enfant	2,757	3,888	3,577	2,005	3,827	5,221
Diarrhée non sanglante adulte	2,563	3,683	3,319	1,838	3,332	4,478
Affections cutanées enfant	1,073	1,393	1,310	705	1,342	1,779
Affections cutanées adulte	1,472	2,029	1,867	1,015	1,882	2,509
Affections des yeux enfant	129	558	133	297	622	129
Affections bucco-dentaires enfant	1,010	1,273	1,208	648	1,248	1,655
Affections bucco-dentaires adulte	719	728	746	398	816	1,065
Troubles mentaux	937	747	698	378	898	61
Traumatismes physiques enfant	2,848	3,333	3,256	1,856	3,329	4,504
Traumatismes physiques adulte	3,131	3,813	3,693	2,095	3,747	5,068
Affections gynécologiques adulte	476	426	468	244	559	729
Malnutrition PE et carences nutritionnelles enfant	1,012	4,979	1,471	7,014	1,629	4,978
Tuberculose pulmonaire enfant	53	54	55	56	2,566	3,380
Tuberculose pulmonaire adulte	1,579	992	1,137	823	2,459	3,242
Méningite (suspect.) enfant	20	63	64	27	53	63
Méningite (suspect.) adulte	20	63	64	27	53	63
Typhus (suspect.) enfant	441	496	497	469	494	485
Typhus (suspect.) adulte	454	510	511	482	507	498
Ecoulement urétral	1,404	1,481	1,341	743	1,579	2,067
Ecoulement vaginal	297	306	306	312	306	298
Ulcération génitale homme	5,177	7,492	6,607	3,680	6,674	8,963
Ulcération génitale femme	5,177	7,492	6,607	3,680	6,674	2,350
Diabète	24	0	0	33	1,001	79
Trypanosomiase enfant	20	63	80	27	164	63
Trypanosomiase adulte	20	63	80	27	164	63
Maladie cardio-vasculaire	489	301	512	0	754	0
Accouchement	1,001	6,254	6,190	3,849	7,453	9,991
Cons. Postnatal (CPON)	123	127	140	129	138	123
Planif. Familiale (PF)	2,086	2,355	2,008	1,156	2,454	3,258
PMTCT	3,133	4,064	3,644	2,052	3,981	5,439

**Please note that only health services with more than one case per year can be evaluated in this study. If '0' is observed, then there were no observed cases of the particular malady for the specific health center and no figure can be estimated.*

Annex 3: Non-weighted Revenue per health service.

Consultations Revenue per Service (FRW)	Byumba Dis	Mukono CS	Munyinya CS	Rushaki CS	Rutare CS	Rwesero CS
Under-five Clinic	2,707	0	5,167	1,659	0	7,691
Fièvre origine inconnue & paludisme présumé adulte	520	715	735	422	1,246	1,431
IAVRS enfant	477	680	634	324	905	988
IAVRS adulte	414	559	545	291	788	845
Consultation Prénatal (CPN)	278	403	345	233	546	669
VCT	1,024	2,194	1,790	659	2,018	2,689
Parasitose intestinale enfant	354	360	390	247	616	610
Parasitose intestinale adulte	323	326	366	233	575	563
Fièvre origine inconnue & paludisme présumé enfant	620	933	896	476	1,433	1,680
IAVRI enfant	1,225	1,923	1,665	850	2,148	2,576
Paludisme confirmé enfant	928	1,533	1,373	684	2,012	2,395
Paludisme confirmé adulte	786	1,215	1,119	606	1,706	2,029
Borréliose confirmée adulte	0	0	0	0	2,002	0
IAVRI adulte	1,329	2,445	2,066	877	2,509	3,104
Diarrhée sanglante enfant	1,036	2,052	1,694	692	2,196	2,717
Diarrhée sanglante adulte	1,059	2,157	1,776	712	2,278	2,835
Diarrhée non sanglante enfant	1,146	2,277	1,877	781	2,465	3,081
Diarrhée non sanglante adulte	1,021	2,146	1,719	651	2,063	2,570
Affections cutanées enfant	502	885	779	342	990	1,138
Affections cutanées adulte	631	1,230	1,035	418	1,271	1,517
Affections des yeux enfant	0	425	0	235	603	0
Affections bucco-dentaires enfant	489	823	734	332	947	1,078
Affections bucco-dentaires adulte	423	539	539	295	746	791
Troubles mentaux	645	640	579	370	908	0
Traumatismes physiques enfant	1,382	2,060	1,850	877	2,276	2,757
Traumatismes physiques adulte	1,462	2,314	2,047	932	2,488	3,046
Affections gynécologiques adulte	313	361	394	238	597	606
Malnutrition PE et carences nutritionnelles enfant	536	3,933	952	6,053	1,311	3,549
Tuberculose pulmonaire enfant	0	0	0	0	2,352	2,573
Tuberculose pulmonaire adulte	1,102	852	923	776	2,259	2,474
Ecoulement urétral	790	1,028	865	452	1,272	1,409
Ulcération génitale homme	2,011	4,290	3,287	1,171	3,925	4,992
Ulcération génitale femme	2,011	4,290	3,287	1,171	3,925	0
Diabète	0	0	0	0	996	0
Maladie cardio-vasculaire	375	321	438	0	789	0
Accouchement	0	4,416	4,017	2,571	5,834	6,729
Planif. Familiale (PF)	1,120	1,556	1,216	619	1,769	2,114
PMTCT	1,366	2,425	1,925	803	2,526	3,220

**Please note that only health services with more than one case per year can be evaluated in this study. If '0' is observed, then there were no observed cases of the particular malady for the specific health center and no figure can be estimated.*

Annex 4: Overview of Human Resource statistics per Health Center

Actual Staffing Patterns (all staff)

	Byumba	Mukono	Munyinya	Rushaki	Rutare	Rwesero
Total number of clinic staff	15.00	9.00	10.00	18.00	15.00	10.00
Total number of administrative staff	1.00	0.00	0.00	0.00	0.00	0.00
Adherence of staff to their health service delivery role	70.0%	204.7%	109.8%	110.0%	80.6%	58.0%
Total number of Médecin	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Infirmièr(e) A1	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Infirmièr(e) A2	9.00	6.00	3.00	9.15	7.00	4.00
Total number of Infirmièr(e) A3	0.00	0.00	0.00	1.00	0.00	0.00
Total number of Travailleur	4.00	2.00	4.00	5.00	5.00	3.50
Total number of Nutritionist(e)	0.00	1.00	0.00	0.10	0.00	0.50
Total number of Animateur(se) de Santé	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Laborantin(e)	1.00	0.00	1.00	0.75	2.00	1.00
Total number of Auxiliaire	1.00	0.00	1.00	1.00	1.00	1.00
Total number of Assistant Social	0.00	0.00	1.00	1.00	0.00	0.00
Average services/staff/hour	1.41	2.56	3.41	2.29	1.50	1.29

Ideal Staffing Patterns (all staff)

	Byumba	Mukono	Munyinya	Rushaki	Rutare	Rwesero
Total number of clinic staff	9.82	18.79	10.98	19.85	12.01	5.53
Total number of clinic staff	10.00	19.00	11.00	20.00	12.00	6.00
Total number of administrative staff	1.00	1.00	1.00	1.00	1.00	1.00
Adherence of staff to their health service delivery role	99.6%	99.8%	99.8%	99.8%	99.7%	99.4%
Total number of Médecin	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Infirmièr(e) A1	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Infirmièr(e) A2	4.72	7.44	5.66	10.36	5.34	2.46
Total number of Infirmièr(e) A3	0.15	0.48	0.14	0.48	0.36	0.19
Total number of Travailleur	0.76	3.74	0.90	1.81	1.88	0.64
Total number of Nutritionist(e)	0.01	0.02	0.01	0.01	0.01	0.01
Total number of Animateur(se) de Santé	0.00	0.00	0.00	0.00	0.00	0.00
Total number of Laborantin(e)	1.97	3.60	2.24	3.20	2.58	1.30
Total number of Auxiliaire	0.84	1.79	0.99	1.81	0.89	0.41
Total number of Assistant Social	1.37	1.72	1.04	2.18	0.95	0.52
Average services/staff/hour	2.13	1.84	2.02	1.97	1.61	1.86

Annex 5: Financial Overview of all Health Centers, Including Capital Outlay and Equipment.

All monetary figures are presented in Rwandan Francs (FRW)

	Byumba Disp.	Mukono CS	Munyinya CS	Rushaki CS	Rutare CS	Rwesero CS
Total expenses and revenue						
Total revenue per scenario	18,687,166	24,854,618	21,884,149	29,034,146	25,772,582	19,491,592
Total expenses per scenario	33,924,546	40,303,336	37,135,635	40,615,969	36,636,994	34,138,123
Difference*	(15,237,380)	(15,448,718)	(15,251,486)	(11,581,823)	(10,864,412)	(14,646,531)
Direct vs Indirect costs						
% variable costs	24%	30%	29%	30%	28%	26%
% fixed costs	76%	70%	71%	70%	72%	74%
Total Cost breakdown						
% total cost from salaries	23%	9%	8%	18%	20%	11%
% total cost from drugs, supplies, lab tests	24%	30%	29%	30%	28%	26%
% total cost from other fixed costs	53%	61%	63%	51%	52%	63%
Cost recovery potential	*55%*	*62%*	*59%*	*71%*	*70%*	*57%*
Per capita data						
Cost per habitant	1028	1618	1807	1441	1444	3921
Curative Services per habitant	0.34	0.73	0.68	1.02	0.46	0.56
Mutuelle data						
Gross mutuelle income 2005	650,076	7,023,701	5,543,706	12,264,200	8,585,995	2,149,768

**Difference includes Capital Outlay Costs. When these costs are not included, all Health Centers have a surplus at the end of the calendar year. For all Health Centers, an annual annuitized sum of FRW 3,227,947 has been used for Capital Outlay.*

Annex 6: Financial Overview of all Health Centers Excluding Capital Outlay and Equipment

All monetary figures are presented in Rwandan Francs (FRW)

	Byumba Disp.	Mukono CS	Munyinya CS	Rushaki CS	Rutare CS	Rwesero CS
Total expenses and revenue						
Total revenue per scenario	18,604,143	24,854,618	21,884,149	28,956,528	25,772,582	19,491,592
Total expenses per scenario	17,986,724	24,448,537	21,280,836	24,683,552	20,782,195	18,283,324
Difference	617,419	406,081	603,313	4,272,976	4,990,387	1,208,268
Direct vs Indirect costs						
% variable costs	45%	50%	50%	50%	49%	48%
% fixed costs	55%	50%	50%	50%	51%	52%
Total Cost breakdown						
% total cost from salaries	43%	15%	15%	30%	35%	21%
% total cost from drugs, supplies, lab tests	45%	50%	50%	50%	49%	48%
% total cost from other fixed costs	12%	35%	36%	20%	16%	31%
Cost recovery potential	*103%*	*102%*	*103%*	*117%*	*124%*	*107%*
Per capita data						
Cost per habitant	545	981	1035	876	819	2100
Curative Services per habitant	0.34	0.73	0.68	1.02	0.46	0.56
Mutuelle data						
Gross mutuelle income 2005	650,076	7,023,701	5,543,706	12,264,200	8,585,995	2,149,768

Annex 7: General Public Health Statistics Overview

	Byumba Disp.	Mukono CS	Munyinya CS	Rushaki CS	Rutare CS	Rwesero CS
General						
Catchment Population	34,747	26,228	21,634	29,671	26,707	9,164
Females of reproductive age	8,131	6,137	5,062	7,177	6,249	2,144
Total curative consultations	11,334	18,203	13,930	28,645	11,610	4,858
Reproductive Health						
Total Institutional deliveries	*N/A**	378	263	564	459	105
% Institutional Deliveries	*N/A**	35.2%	29.7%	46.4%	41.9%	27.9%
First ANC visits uptake	93.8%	89.4%	111.5%	62.7%	87.1%	71.4%
Total new FP acceptors	469	368	187	356	484	64
Average end of month FP users (% of expected)	5.3%	4.0%	12.6%	3.1%	11.8%	2.7%
Immunizations						
Under-five Clinic	2,124	*N/A**	1,233	6,934	*N/A**	1,095
HIV services						
Total VCT visits	2,010	681	485	3,009	673	108
VCT uptake	6%	3%	2%	10%	3%	1%
Total PMTCT visits	1,325	398	270	1,142	983	229
PMTCT uptake	95%	38%	31%	96%	92%	62%

**N/A indicates that data is either not available or service is not offered by Health Center.*

Annex 8: An Example of a Filled Service Practice Worksheet: a Case of Malaria in a Child.

CORE Plus (Outil de Détermination des Coûts et des Recettes : MSH/PBF Project, avec support de USAID/ Rwanda) — District:

Feuille de calcul des prestations — Quantité de services par cas: 1.00

C:\Documents and Settings\gfritsche\My Documents\MSH Rwanda\54. CORE STUDY\070607_CORE-PLUS R\CORE Plus R Tool\Byumba\[070515_CORE_Rw Byumba.xls]Paludisme_présumé_enfant

Section 1 : Temps du personnel de prestation

Service: Fièvre origine inconnue & paludisme présumé enfant *Par cas ou par visite?* visite

Activité	Méd	A1	A2	A3	Trav	Nutr	Animat	Labo	Aux	Ass Soc	Total	Remarques/Commentaires
	Temps de prestation de services (en minutes) par catégorie du personnel											
Enregistrement et accepter le paiement										5.0	5.0	
Enregistrement et Anamnèse			4.8						0.3		5.0	
Examen Physique			4.8						0.3		5.0	
Poser le Diagnose de Presumption			1.0						0.1		1.0	
Prescrire examen de labo			1.0						0.1		1.0	Pharmacy manned by an A2 nurse
Examen Complémentaire								28.5			28.5	Assume 95% is sent to lab
Ecrire le resultats de labo			1.0						0.1		1.0	
Prescription medicaments			1.9						0.1		2.0	
Explication du Traitement			7.6						0.4		8.0	
Facturation									5.0		5.0	
											0.0	
											0.0	
Total : Temps du personnel de	**0.0**	**0.0**	**21.9**	**0.0**	**0.0**	**0.0**	**0.0**	**28.5**	**6.2**	**5.0**	**61.5**	
Par visite:	**0.0**	**0.0**	**21.9**	**0.0**	**0.0**	**0.0**	**0.0**	**28.5**	**6.2**	**5.0**	**61.5**	

Section 2: Médicaments et consommables médicaux

Service: Fièvre origine inconnue & paludisme présumé enfant *Par cas ou par visite?* visite

Médicament, protocole, dosage et unité	Combien de fois par jour	des jours ou cycles	% de cas traités	lation du médicament	Dosage	Unités par dose	Total des unités	Coût unitaire	Coûts additionnels (2%)	moyen pondéré de traitement		Commentaires
Acide acétylsalicylique (AAS) 300mg	3	3	25%	compr	20mg/kg	1.00	2.25	2.00	0.04	4.59		say 25 kgs
Amodiaquine 200mg 6 cp + SP 2 cp	1	3	90%	compr		1.00	2.70	90.00	1.80	247.86		New protocol in 2006 will change this!!!!
Mébendazole 100mg Cp	2	3	25%	compr		1.00	1.50	4.00	0.08	6.12		
Paracétamol 100mg Cp	3	3	50%	compr	10mg/kg	1.00	4.50	2.00	0.04	9.18		say 10 kgs
Paracétamol 500mg Cp	3	3	25%	compr		1.00	2.25	3.00	0.06	6.89		
Quinine sirop 100mg/5ml, 120ml	3	7	4%	sirop		0.05	0.04	610.00	12.20	23.33		
Quinine sulfate 300mg Cp	3	7	1%	compr		1.00	0.26	15.00	0.30	4.02		
Amoxycilline 250mg Cp	3	7	5%	compr		1.00	1.05	14.00	0.28	14.99		say 25 kgs
							-	-	-	-		
							-	-	-	-		
										Moyenne du coût des médicaments par visite:	**par visite:**	**316.98**

Consommables médicaux	médicament associe (si IM ou IV)	Quantité par admin.	Nombre admin.	Quantité total	% de cas traités	Présentation	Unité administrée	Total des unités	Coût unitaire	Coûts additionels (0.5%)	Coût moyen pondéré de traitement	Commentaires
Sachet Minigrip		2.00	1.00	2.00	100%		1	2.00	5.00	0.03	10.05	
				-				-	-	-	-	
				-				-	-	-	-	
										Moyenne du coût des fournitures par visite:	**10.05**	**10.05**

Section 3: Tests de laboratoire

Service: Fièvre origine inconnue & paludisme présumé enfant *Par cas ou par visite?* visite

Test de laboratoire	Quantité	% de cas testés							Coût unitaire	moyen pondéré de labo		Commentaires
Urine	1.00	2.50%							29.32	0.73		
Gouttes Epaisses (GE)	1.00	95.00%							19.55	18.57		
Globules Blancs (WBC)	1.00	6.25%							-	0.00		
Hb, Ht CS	1.00	3.13%							-	0.00		25% of CS did this in 2005 (12.5% cases * 0.25)
									-	0.00		
									-	0.00		
										Moyenne du coût des tests de labo par visite:	**par visite:**	**19.30**

Annex 9: Indexation for HIV PBF indicators

No	Performance Indicator	Index	Actual Value FRW
1	VCT: people tested	100	500
2	PMTCT: pregnant women tested	50	250
3	PMTCT/VCT : couples tested	500	2500
4	PMTCT: mother and newborn-pair provided with ARV prophylaxis acc to Nat Prot	500	2500
5	PMTCT: infants born to HIV+ mothers seen monthly at the health facility for CTX	100	500
6	PMTCT: infants born to HIV+ mothers tested for HIV	1000	5000
7	Care: number of HIV+ clients that are staged six monthly (CD4)	500	2500
8	Care: HIV+ clients treated with Cotrimoxazol monthly	50	250
9	ARV new clients	500	2500
10	ARV new pediatric client	750	3750
11	ARV: ARV client visit at one month (after having been put on treatment)	500	2500
12	ARV: ARV client visit at six month intervals	200	1000
13	TB patients tested for HIV voluntarily*	300	1500

* Two more indicators were added later: HIV+ clients tested for STDs and HIV+ clients using modern FP methods

Annex 10: Listing of PMA and HIV indicators

No	National PBF indicators with their indexes	Value (FRW)	Value (USD)
1	1. CPC - Nouveaux cas	100	$0.18
2	2. CPN - Nouveaux cas	50	$0.09
3	3. CPN - Femmes avec 4 visites	200	$0.37
4	4. CPN - VAT 2 - 5	250	$0.46
5	5. CPN - 2ème prise de Sulfadoxine	250	$0.46
6	6. CPN - Grossesses à risque Referees avant le 9ieme mois	1000	$1.83
7	7. Suivi de la croissance : enfant de 11 a 59 mois consultés (CS)	100	$0.18
8	8. Suivi de la croissance : enfant de 11 a 59 mois consultés (PNBC)	100	$0.18
9	9. Malnutris : Hospitalise sortant guéri ou réfère	2000	$3.67
10	10. P.F : Nouvelle utilisatrice	1000	$1.83
11	11. P.F : Utilisatrice en fin du mois	100	$0.18
12	12. Vaccination : Enfant complètement Vaccine	500	$0.92
13	13. Accouchement assiste au CS	2500	$4.59
14	14. Accouchement : référence d'urgence pour accouchement	2500	$4.59
15	15. Références d'urgence	1000	$1.83
16	1. VCT : nombre des patients testés	500	$0.92
17	2. PMTCT: nombre des femmes enceintes testées	250	$0.46
18	3. PMTCT/VCT: nombre des couples et partenaires testés	2,500	$4.59
19	4. PMTCT: mère et son enfant traités avec ARV selon le protocole nationale	2,500	$4.59
20	5. PMTCT : Enfants nées de mères VIH+ vu chaque mois au FOSA pour traitement CTX	500	$0.92
21	6. PMTCT : Enfants nées de mères VIH+ testées pour VIH	5,000	$9.17
22	7. Soins : Nombre des patients VIH+ testés pour CD4 chaque six-mois	2,500	$4.59
23	8. Soins : Nombre des patients VIH+ traités aux CTX chaque mois	250	$0.46
24	9. ARV : Nombre des nouveaux patients adultes traités aux ARV	2,500	$4.59
25	10. ARV : Nombre des nouveaux patients pédiatriques traités aux ARV	3,750	$6.88
26	11. ARV : Nombre des patients sous ARV consultés après un mois de traitement	2,500	$4.59
27	12. ARV : Nombre des patients ARV consultes a six-mois intervalles	1,000	$1.83
28	13 : VIH prévention : Nombre des femmes VIH+ qui utilisent le PF	1,500	$2.75
29	14 : TB/MST : Nombre des patients VIH+ qui ont étés examinés pour MST	1,500	$2.75
30	15 : TB/MST : Nombre des patients VIH+ qui ont étés examinés pour TB	1,500	$2.75

Annex 11: Breakdown of HIV costs

Direct: supplies and drugs, direct personnel time
Indirect: Other functioning costs
slack: personnel slack time

VCT

Including Capital Outlay

	Health Center 1	Health Center 2	Health Center 3	Health Center 4	Health Center 5	Health Center 6
Total Direct Costs:	1,364.22	1,320.68	1,392.70	1,412.99	1,384.38	1,372.04
Total Indirect Costs:	1,173.97	2,482.79	2,119.87	537.22	1,995.14	3,292.45
Total Slack Costs:	105.96	-17.01	-45.63	-60.64	26.63	52.84
Total Costs:	2,644.15	3,786.46	3,466.95	1,889.57	3,406.16	4,717.33

Including Capital Outlay	
Average	**3,318.4**
StDev	**969.7**

Excluding Capital Outlay

	Health Center 1	Health Center 2	Health Center 3	Health Center 4	Health Center 5	Health Center 6
Total Direct Costs:	1,364.22	1,320.68	1,392.70	1,412.99	1,384.38	1,372.04
Total Indirect Costs:	202.29	948.17	717.42	138.39	456.03	987.23
Total Slack Costs:	105.96	-17.01	-45.63	-60.64	26.63	52.84
Total Costs:	1,672.47	2,251.84	2,064.50	1,490.74	1,867.05	2,412.12

Excluding Capital Outlay	
Average	**1,959.8**
StDev	**349.9**

Including Capital Outlay

	Health Center 1	Health Center 2	Health Center 3	Health Center 4	Health Center 5	Health Center 6
Total Direct Costs:	1,554.88	1,424.05	1,480.92	1,857.70	1,602.72	1,550.76
Total Indirect Costs:	1,338.05	2,677.12	2,254.14	591.03	2,309.80	3,721.30
Total Slack Costs:	240.14	-37.01	-91.42	-93.93	68.80	166.72
Total Costs:	3,133.07	4,064.16	3,643.64	2,354.80	3,981.31	5,438.78

Including Capital Outlay	
Average	**3,769.3**
StDev	**1,033.5**

Excluding Capital Outlay

	Health Center 1	Health Center 2	Health Center 3	Health Center 4	Health Center 5	Health Center 6
Total Direct Costs:	1,554.88	1,424.05	1,480.92	1,554.52	1,602.72	1,550.76
Total Indirect Costs:	230.56	1,022.39	762.86	152.25	527.95	1,115.82
Total Slack Costs:	240.14	-37.01	-91.42	-93.93	68.80	166.72
Total Costs:	2,025.58	2,409.42	2,152.36	1,612.84	2,199.46	2,833.30

Excluding Capital Outlay	
Average	**2,205.5**
StDev	**405.5**

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