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COST OF HIV & AIDS ADULT AND PEDIATRIC CLINICAL CARE AND TREATMENT IN GHANA

SEPTEMBER 2010

This publication was produced for review by the U.S. Agency for International Development (USAID). It was prepared by James Rosen and Felix Asante, consultants of the Health Policy Initiative, Task Order I.

Suggested citation: Rosen, J., and F. Asante. 2010. *Cost of HIV & AIDS Adult and Pediatric Clinical Care and Treatment in Ghana*. Washington, DC: Futures Group, Health Policy Initiative, Task Order I.

The USAID | Health Policy Initiative, Task Order I, is funded by the U.S. Agency for International Development under Contract No. GPO-I-01-05-00040-00, beginning September 30, 2005. HIV-related activities of the initiative are supported by the President's Emergency Plan for AIDS Relief. Task Order I is implemented by Futures Group, in collaboration with the Centre for Development and Population Activities (CEDPA), White Ribbon Alliance for Safe Motherhood (WRA), and Futures Institute.

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The views expressed in this publication do not necessarily reflect the views of the U.S. Agency for International Development or the U.S. Government.

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FOREWORD

The Government of Ghana has responded progressively to the HIV epidemic using locally generated evidence and gradually scaling up effective HIV interventions. Good estimates, projections, and planning are dependent on having knowledge about accurate costs. This study examines the cost of adult and pediatric HIV & AIDS treatment and care in Ghana. Understanding the costs and components of HIV & AIDS care and treatment will allow for sustainable scale-up of those services and provide evidence to ensure that sufficient resources are available for that expansion. This is one of the first studies to look at the costs of care and treatment in Ghana and provides valuable information for the planning and monitoring of the program.

The Ghana AIDS Commission and the National AIDS Control Programme are grateful to all the researchers and most importantly to the participating institutions for contributing this body of knowledge to help streamline the environment in which we deliver the national response. The recommendations made will help to shape the development of the National Strategic Plan for HIV&AIDS (2011–2015) and to inform health sector programs so as to contribute toward the Millennium Development Goals.

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ACKNOWLEDGMENTS

Sincere thanks go to the core study team, including the following individuals:

- Dr. Angela El-Adas, Acting. Director-General, Ghana AIDS Commission (GAC)
- Dr. Richard Amenyah, Director of Technical Services, Ghana AIDS Commission (GAC)
- Dr. Nii Akwei Addo, Programme Manager, National AIDS Control Program (NACP)
- Kyeremeh Atuahene, Ag. Director of Research, Monitoring and Evaluation
- Kwadwo Asante, Monitoring and Evaluation, National AIDS Control Program (NACP)
- Gertrude Akpalu, NSP Coordinator, Ghana AIDS Commission (GAC)
- Peter Wondergem, HIV & AIDS Advisor, USAID/Ghana
- Rachel Sanders, Health Policy Initiative, Washington, D.C.
- Maj-Britt Dohlie, Health Policy Initiative, Ghana Country Manager/Programme Advisor

Particular gratitude goes to staff of the Ridge Regional Hospital's anitretroviral treatment clinic, especially Dr. Farida Abdulai, for enabling the pre-test of the survey questionnaire in the clinic. Thanks also go to the many people and institutions that answered questions and provided information on resource use and prices. Data collection at the facility was carried out by Maxwell Yeboah, Alex Appau, Daniel Anderson, James Allotey-Annan, and John Adjei. Thanks go to the many health workers at the study sites who kindly gave of their time and expertise. Our main contacts are listed below.

Region	HIV Coordinator/Focal Persons
Greater Accra Region	Mrs. Beatrice Okoh (HIV Coordinator) Dr. Margaret Lartey Ms. Deborah Dadzie Ms. Vivian Damoah Mr. Adolph Antwi Mr. Ankrah
Eastern Region	Dr. Sampson Ofori (HIV Coordinator) Ms. Gifty Addo Tetebo Dr. Obeng Dr. Katherine Dawson Amoah
Upper West Region	Ms. Genevieve Yiripare (HIV Coordinator) Mr. Emmanuel Wondoh Mr. Yakubu Tifere Mr. Peter Wuri
Brong Ahafo Region	Mr. William Sopimeh (HIV Coordinator) Dr. Fofie Dr. Ben Azu Bioko Dr. Geraldo Dr. Ameyaw

EXECUTIVE SUMMARY

This report presents results from a study of unit costs of HIV & AIDS clinical care and treatment services in Ghana. Carried out between March and August 2010, the study represents the national program's first effort to undertake a comprehensive analysis of the unit costs of care and treatment. The study was a joint effort of Ghanaian government agencies, the U.S. Agency for International Development (USAID), and the USAID | Health Policy Initiative, Task Order 1. Costing focused on services that the national program already delivers in a clinical setting, such as pre-antiretroviral therapy, antiretroviral therapy, care and treatment for opportunistic infections, and nutrition support. The study aimed to produce estimates for both adult and pediatric care.

Methodology

The study analyzed unit cost, defined as the cost of caring for one client for one year. The general approach to costing was bottom-up; that is, ingredients costing of the factors involved in the direct costs of each intervention combined with elements of top-down costing to obtain some direct and most indirect unit costs. The study chose a purposive sample of 15 of Ghana's 138 clinical care sites operating as of December 2009. The sites reflect key characteristics thought to influence unit cost, including level of facility, ownership, location within country, and HIV prevalence in the surrounding catchment area.

The study team collected information at the 15 facilities and at the regional and central levels to determine the full range of direct and indirect inputs to the clinical care and treatment program. The team used 2010 prices to value the inputs at their economic cost. Despite some limitations in the collection of input and price data, the study produced useful results that were subjected to standard cost analyses.

Results

The study found an average yearly cost of GH¢ 758 (US\$534) per adult. The cost per year for a pediatric client was about 10 percent higher at GH¢ 825 (US\$582), mainly because of the greater expense in providing antiretroviral (ARV) drugs to children. The results place Ghana well within the "normal" range of unit costs reported from recent studies in other countries. Sensitivity analyses showed that the unit cost estimate could vary within a plausible range between GH¢ 645 (US\$473) and GH¢ 801 (US\$563). Analysis of the program's cost structure found that direct costs accounted for 63 percent of total cost and that indirect costs represented 37 percent of total cost. The two major contributors to cost were antiretroviral drugs (27% of total cost) and laboratory testing (23%). General support costs of the national antiretroviral therapy (ART) program (17%) and training (14%) were the two largest sources of indirect program costs. Other contributors to costs included service delivery staff (6%), drugs for prophylaxis and treatment of opportunistic infections (5%), and general national support costs of the Ghana Health Service (3%). Fixed costs accounted for 45 percent and variable costs for 55 percent of total cost. Current costs account for 83 percent of total cost and capital costs for just 17 percent.

Outcomes varied somewhat when the study analyzed the results by characteristics thought to influence unit cost levels. For example, unit costs at the two teaching and four regional hospitals were about 25 percent lower than costs at the nine district hospitals. The variation stemmed mainly from higher client loads at teaching and regional hospitals, which allowed ART clinics at these sites to spread some fixed program costs across a large client pool.

It is essential to understand how unit costs might vary as the national program scales up, particularly given the program's planned expansion, which—despite recent growth—currently covers only 28 percent of adults and 15 percent of children in need of antiretroviral therapy. Expansion of the client base at existing sites will most likely bring down unit costs, especially if most scale-up occurs at relatively high-

cost district facilities. In contrast, expansion through the establishment of new clinical care sites will probably increase average unit costs nationally because almost all new sites will be located at higher-cost district hospitals.

Information Use

The study has already provided inputs to the Goals Model for five-year projections of the cost and impact of various combinations of HIV & AIDS interventions and for examining the cost implications of projected changes in first- and second-line drug regimens. The projections have proved valuable to those developing the HIV & AIDS National Strategic Plan (2011–2015). Local stakeholders should use the results to look more closely at a range of topics, including how to make more efficient use of resources (e.g., for health workers, laboratory testing, and equipment); the cost impact of different scale-up approaches; changes in ARV drug regimens and their effect on cost; and impact analysis through models such as Goals.

ABBREVIATIONS

AIDS	acquired immune deficiency syndrome
ART	antiretroviral therapy
ARV	antiretroviral
GAC	Ghana AIDS Commission
GHS	Ghana Health Services
HIV	human immunodeficiency virus
MOH	Ministry of Health
NACP	National AIDS/STI Control Program, Ghana
NGO	nongovernmental organization
NHIS	National Health Insurance Scheme
NSF	National Strategic Framework
OI	opportunistic Infection
STI	sexually transmitted infection
UNAIDS	Joint United Nations Program on HIV and AIDS
UNFPA	United Nations Population Fund
UNICEF	United Nations Children’s Fund
USAID	United States Agency for International Development

INTRODUCTION AND BACKGROUND

This report presents the results from a study of unit costs of HIV & AIDS clinical care and treatment services in Ghana. The idea for the study emerged from discussions with government officials in February 2010, as the government was gearing up to develop its HIV & AIDS National Strategic Plan (2011–2015). The discussions focused on how to incorporate into the new plan some projections of the costs, coverage, and potential impacts of various HIV & AIDS interventions. Meetings with government officials revealed that relatively little information was available on the cost of many key interventions, particularly care and treatment interventions. Recognizing this gap, participants in the February 2010 discussions agreed to move forward with the collection and analysis of data on the unit costs of the country’s HIV & AIDS care and treatment program. A study team quickly formed, comprising representatives from the government, U.S. Agency for International Development (USAID), and USAID | Health Policy Initiative, Task Order 1. In March 2010, the team developed a methodology and data collections instruments. Government officials reviewed and approved the documents in early April 2010, paving the way for the subsequent fieldwork, data analysis, and dissemination of results.

The principal government agencies involved in the study were the Ghana AIDS Commission (GAC) and the National AIDS/STI Control Program (NACP) of the Ghana Health Service. The GAC and NACP provided technical guidance, reviewed and commented on the study methodology, facilitated access to primary data and secondary information, facilitated entry to health facilities, ensured the collaboration of facility staff, and reviewed and commented on reports. USAID funded the study, provided technical guidance, reviewed and commented on the study methodology, facilitated travel by international consultants, and reviewed and commented on reports. The Health Policy Initiative was accountable for all aspects of the study; developed the methodology, protocols, and data collection and analysis plans; pre-tested the study protocols; trained data collectors; collected, cleaned, entered, and analyzed data; and disseminated the results. The study was carried out between March and August 2010.

Table I. Timeline for Ghana ART Cost Study, March through August 2010

	March					April					May					June					July					August									
1. Develop methodology and tools	x	x	x	x	x																														
2. Carry out field work and data collection						x	x	x	x	x	x	x	x																						
3. Clean and enter data														x	x	x	x																		
4. Analyze data																		x	x	x															
5. Draft report																							x	x	x										
6. Disseminate results																																			x
7. Submit final report																																			x

HIV & AIDS in Ghana

The fight against HIV & AIDS is an integral component of Ghana’s efforts to improve the country’s social and economic conditions. Although not as hard hit as many of the countries of Eastern and Southern Africa, HIV & AIDS continues to impede Ghana’s national development efforts. The HIV &

AIDS epidemic in Ghana is a mature, mixed epidemic (low-level generalized epidemic with pockets of high infection levels among certain populations). Infection in the general population depends to a great extent on continuous bridging from core high prevalence sub-populations, such as female sex workers, their clients and non-paying partners, and men who have sex with men. HIV prevalence was estimated to be 1.9 percent in the general adult population in 2009 (NACP, 2010b). Prevalence among pregnant women as reported by Ghana's antenatal care sentinel surveillance system declined from a peak of 3.6 percent in 2003 to 2.9 percent in 2009 (while not consistent across each year, the linear trend across the period is downward) (NACP, 2010a). Prevalence at sentinel surveillance sites varies substantially among Ghana's 10 regions, with regional rates in 2009 ranging from 2.0 percent in the Northern Region to 4.2 percent in the Eastern Region. Rates are also significantly higher in urban than in rural areas (NACP, 2010a). Infection rates for sex workers and for men who have sex with men are almost 10 times higher than for the general population (GAC, 2009). Of those infected with HIV, 91.8 percent are infected with HIV-1 and the remaining 8.2 percent with HIV-2 and a combination of HIV-1 and HIV-2 (NACP, 2010a).

These prevalence rates mean that an estimated 267,069 people were living with HIV & AIDS in 2009, including 25,666 children under age 15 (NACP, 2010b). Of those infected, an estimated 98,980 adults and 11,836 children need antiretroviral therapy (NACP, 2010b). Of those in need of antiretroviral therapy (ART), 28,648 adults (29%) and 1,617 children (14%) were receiving the life-saving drugs (NACP personal communication, 2010). Program officials expect the number of treated individuals to rise rapidly as Ghana scales up its care and treatment program.

Program and Policy Response to HIV & AIDS in Ghana

Ghana has a long-standing, comprehensive national response to the HIV epidemic, beginning with the establishment of the National AIDS/STD Program in 1987 (GAC, 2006). Under the GAC's coordination, the government is currently implementing the final year of the National Strategic Framework II 2006–2010 (NSF II) and has started to develop its five-year National Strategic Plan 2011–2015. The NSF II identifies treatment, care, and support as one of seven intervention areas (GAC, 2006). The public health system started providing ART in June 2003 at two pilot sites (NACP, 2005) and quickly increased coverage to 91 sites by 2007. As of December 2009, the ART program operated in 138 sites, providing services to both adults and children (GAC 2010 Country Progress Report). ART clinics operate at the country's 2 central teaching hospitals, all 10 regional hospitals, and 126 districts hospitals located in 95 of the country's 170 districts (NACP 2010, personal communication).¹ Care and treatment interventions make up an essential component of the Ghana national response, accounting for about one-fourth of all HIV & AIDS spending in 2008—US\$ 9.6 million out of a total US\$ 38.8 million (Asante, 2010).

Study Rationale

Despite the importance of care and treatment within the national response to the HIV epidemic, few studies have examined the cost of care and treatment in Ghana. The handful of cost studies used broad national estimates (Asante and Fenny, 2008; Bollinger et al., 1999) or took the form of prospective studies based on expected—not actual—resources and prices (Torpey, 2003). Moreover, no study in Ghana (and few internationally) has examined unit costs for pediatric ART programs—a growing component of Ghana's care and treatment program. The present study was therefore timely for the following reasons:

- First, Ghana's care and treatment program is evolving. Protocols have recently changed, and costs of key inputs such as antiretroviral (ARV) drugs have decreased. Drug regimens are also changing. Even relatively small shifts in drug pricing may translate into large differences in total

¹ A few health centers provide ART services.

cost over a five-year period—an important consideration in program planning. A cost study carried out now will provide information on the most recent cost changes.

- Second, the government is currently developing its national strategic plan for its HIV & AIDS program, expected to be completed by October 2010, to cover the period January 2011 through December 2015. Good cost information is one key piece of knowledge that decisionmakers need in selecting among program options.
- Third, Ghana is in the midst of other planning and proposal writing processes that require unit cost data. For example, Ghana was expected to compete for funding under Round 10 of the Global Fund for AIDS, Tuberculosis and Malaria. With the expected focus of the Round 10 application on care and treatment, the present study could help the government prepare a sound, well-costed proposal.

Although it might be tempting for Ghana to develop national cost estimates based on unit cost data generated from studies in other countries, such an approach could yield misleading results. Moreover, despite growing international experience, the costing of AIDS programs is a relatively recent undertaking (Kombe et al., 2009). In fact, UNAIDS published its first “Guidelines for Costing HIV & AIDS Prevention Strategies” in 2000. In addition, retrospective cost studies of actual versus prospective costing of planned programs are of relatively recent vintage, reflecting the scale-up of treatment programs in the past five years or so (Kombe, 2009). Such studies have now been carried out in a range of countries with reported costs for a care and treatment package ranging from US\$300 to more than US\$1,000 per year per client (see Table 2). Yet, HIV & AIDS program costs—especially for those enrolled in ART programs—have changed rapidly; thus, results from studies undertaken even a few years ago may be outdated. Furthermore, differences in relative prices, program protocols, what programs include under the rubric of “care and treatment,” and costing methodologies make it difficult to compare study results between countries. For these and other reasons, experts recommend reliance on local unit cost data whenever feasible in the development of national cost estimates (Bollinger and Stover, 2007; Hester et al., 2009).

Table 2. Unit Costs from Recent ART Costing Studies in Other Countries

Study	Country, Year	Unit Cost (US\$)	Unit	Comment
Badri e tal., 2006	South Africa, 2004	\$964–\$1,513	Per person per year	Includes both in-patient and out-patient costs
Bollinger and Stover, 2007	Various countries and years	\$222 \$1,635 \$191 \$145 \$7 \$17 \$74 \$145	First-line ARV for 1 year Second-line ARV for 1 year Laboratory Opportunistic infection (OI) treatment and care OI prophylaxis Counseling Nutrition supplement Tuberculosis drugs	Low-income countries Low-income countries World average Sub-Saharan Africa Sub-Saharan Africa Sub-Saharan Africa Sub-Saharan Africa Females
Global Fund, 2010	Various countries, 2009	\$188 \$526 \$1,220	1 adult patient-year ² ARV first-line regimen ART per person per year ART per person per year	Median drug cost only First line, low-income countries Second line, low-income countries

² A patient-year of treatment is equivalent to one patient treated for one year.

Study	Country, Year	Unit Cost (US\$)	Unit	Comment
Health Systems 20/20, 2009	Côte d'Ivoire, 2009	\$119	Pre-ART per patient-year	Includes co-trimoxazole prophylaxis and monitoring laboratory tests
		\$625	1 patient-year treatment	Averaged over both first- and second-line therapies (switching first line from d4T to AZT-based regimens)
		\$1,116	1 patient-year treatment	Averaged over both first- and second-line therapies (switching first line from d4T to TDF-based regimens)
Quentin et al., 2008	Rwanda, 2006	\$504.39 \$91.30	1 patient-year ART 1 patient-year pre-ART	
Resch et al., 2009	Nigeria, 2009	\$811–\$827	1 patient-year of treatment	5-year period
		\$116–\$121	Pre-ART monitoring (laboratory and clinic visits)	5-year period
Rosen and Long, 2006	Sub-Saharan Africa, various years	\$850	1 patient-year of treatment	Average of 7 studies outside South Africa
		\$1,700	1 patient-year of treatment	Average of 10 studies in South Africa
		\$1,200	1 patient-year of treatment	Average of more recent South Africa studies
Sanders, 2009	Rwanda, 2009	\$319	1 patient-year of treatment	Drugs, laboratory services, OI prophylaxis, pre-ARV, nutrition support

Source: Authors.

INTERVENTIONS COSTED

Although Ghana needs reliable cost information on all national HIV & AIDS interventions, including prevention, the relatively large role of clinical care and treatment in the overall national response made it a priority for the study team to maintain the focus of the research on clinical care and treatment. Moreover, time and budget constraints limited the potential scope of the study. Criteria for inclusion of interventions in the study follow:

- Services focused on care and treatment of HIV-positive people
- Services provided in a clinical setting
- Services already widely provided in the clinical setting

There is no simple and neat way to categorize all the interventions that comprise HIV clinical care and treatment. However, for purposes of this study, the team grouped the spectrum of actions into the following four interventions based on Ghana's national care and treatment guidelines, as shown in Annex 1 (see NACP, 2008a; 2008b).

Pre-antiretroviral Therapy

Clients enroll in the clinical care program but are not yet on ART. Those who test positive for HIV at one of the more than 800 counseling and testing sites in Ghana are referred to an ART clinic, where they undergo further counseling and testing to determine their eligibility for antiretroviral therapy. At this stage, clients undergo a comprehensive medical history and undergo a physical examination, counseling, initial laboratory testing, and follow-up visits as needed for counseling as well as for continued monitoring of their immune status and other signs and symptoms that determine their eligibility for ART.

Antiretroviral Therapy

Once a client is eligible for treatment, he or she undergoes adherence counseling, begins receiving drugs, undergoes periodic laboratory testing, and participates in follow-up counseling. An adult with a CD4 count of 350 cell/mm³ or below is eligible for ART and starts a triple-drug regimen. Treatment regimens are similar in children and adults, with drug dosing in children varying by weight and other factors (see Table 3 and Table 4). Laboratory testing is essentially the same for adults and children, except in the case of the CD4 assay, with CD4% the preferred parameter for children up to age six. Counseling for clients taking ARVs includes 3 adherence counseling visits before initiation, then check-ups every 2 weeks, then monthly visits for the first 3 months. Once a client is stable, he or she is expected to visit the clinic every three months for ARV re-stocking, screening and monitoring, and adherence counseling. For child ART clients, counseling includes parents or guardians. Some clinics may employ lay adherence counselors to supplement clinic staff, particularly peer counselors who work with Models of Hope, a program that trains and assists support groups of people living with HIV to serve as trusted adherence counselors.³

Table 3. Projected Distribution of Adult ARV Clients by Drug Regimen, Ghana (2010–2012)

Regimens	2010		2011		2012	
	Clients	Percent	Clients	Percent	Clients	Percent
Adult First Line						
lamivudine + efavirenz + stavudine	5,691	15.0%	7,625	14.4%	10,217	13.8%
lamivudine + nevirapine + stavudine	9,542	25.1%	14,651	27.7%	22,495	30.3%
zidovudine/lamivudine + efavirenz	7,360	19.3%	8,978	16.9%	10,953	14.8%
zidovudine/lamivudine + nevirapine	15,464	40.6%	21,726	41.0%	30,523	41.1%
Adult Second Line						
abacavir + lopinavir/low-dose ritonavir + didanosine	186	28.4%	245	26.9%	323	24.1%
abacavir + lopinavir/low-dose ritonavir + tenofovir	63	9.6%	91	10.0%	130	9.7%
abacavir + didanosine + nelfinavir	80	12.2%	108	11.8%	147	11.0%
lamivudine + stavudine + nelfinavir	149	22.8%	275	30.2%	505	37.7%
zidovudine/lamivudine + nelfinavir	19	2.9%		0.0%		0.0%
lamivudine + efavirenz + didanosine	129	19.7%	159	17.4%	195	14.5%

³ The program does not employ a specific cadre of health workers (paid or volunteer) dedicated to outreach and retention of ART clients.

zidovudine/lamivudine + lopinavir/low-dose ritonavir	28	4.3%	34	3.7%	41	3.1%
Total First Line	38,057	98.3%	52,980	98.3%	74,188	98.2%
Total Second Line	654	1.7%	912	1.7%	1,341	1.8%
Total All Clients	38,711	100.0%	53,892	100.0%	75,529	100.0%

Source: NACP.

Table 4. Projected Distribution of Pediatric ARV Clients by Drug Regimen, Ghana (2010–2012)

Regimens	2010		2011		2012	
	Clients	Percent	Clients	Percent	Clients	Percent
Pediatric First Line						
zidovudine + lamivudine + efavirenz (10–15 kg)	167	15.1%	267	15.1%	429	15.2%
Zidovudine + lamivudine + efavirenz (15–20 kg)	334	30.2%	535	30.3%	857	30.4%
Zidovudine + lamivudine + efavirenz (20–25 kg)	154	13.9%	246	13.9%	392	13.9%
Zidovudine + lamivudine + efavirenz (25–30 kg)	119	10.8%	190	10.8%	304	10.8%
Zidovudine + lamivudine + nevirapine (5–10 kg)	215	19.5%	345	19.5%	554	19.6%
Zidovudine + lamivudine + nevirapine (10–15 kg)	58	5.2%	91	5.2%	142	5.0%
stavudine + lamivudine + efavirenz (20–25 kg)	48	4.3%	78	4.4%	125	4.4%
stavudine + lamivudine + nevirapine (5–10 kg)	10	0.9%	14	0.8%	20	0.7%
Pediatric Second Line						
stavudine + lamivudine + abacavir (10–15 kg)	84	100.0%	133	100.0%	213	100.0%
Total First Line	1,105	93%	1,766	93%	2,823	93%
Total Second Line	84	7%	133	7%	213	7%
Total All Clients	1,189	100%	1,899	100%	3,036	100%

Source: NACP.

Opportunistic Infection Care and Treatment

Care and treatment of opportunistic infections (OIs) associated with HIV & AIDS is an integral component of Ghana's national response to the epidemic. Care and treatment of OIs should begin upon enrollment in the clinical care program, starting with prophylaxis and continuing with care and treatment as needed as long as the client remains in the program. Tuberculosis is among the most prevalent of opportunistic infections in HIV & AIDS clients (NACP, 2008b).

Nutrition Support

Ghana's clinical care and treatment program defines care and support activities to include nutritional assistance, and the NSF II promotes adequate nutrition for people on ART. Nutrition support includes both a clinical and community component. The clinical component currently includes nutrition counseling as part of standard counseling for pre-ARV and ARV clients.⁴

Interventions Not Costed

Ghana's clinical care and treatment program includes other interventions that are sometimes grouped under the rubric of care, treatment, and support. The present study did not include the following:

- *Orphan and Vulnerable Children (OVC) care.* The activities do not take place in a clinical setting. Moreover, no standard national model exists for OVC care.
- *Counseling and testing.* For purposes of this study, counseling and testing for people not yet enrolled in an ART program was considered a prevention program.⁵
- *Prevention of mother-to-child-transmission.* Considered part of the prevention program.
- *Home-based care.* Such care is not clinic-based; moreover, models currently operate only in limited areas.

TARGET AUDIENCES FOR THE STUDY

Many stakeholders in Ghana have an interest in the cost of HIV & AIDS programs. The study team defined the following target audiences, ranked in order of importance:

1. The Government of Ghana, including the GAC, NACP and its Treatment Working Group, Ghana Health Service, Ghana Ministry of Health, finance ministry, and other ministries
2. USAID and other U.S. government agencies and other international donor and technical assistance agencies
3. Civil society organizations in Ghana providing clinical care and advocating for HIV & AIDS treatment

STUDY QUESTIONS

With these audiences in mind, the study team identified the following key study questions:

How much does it cost Ghana to provide clinical care and treatment for one adult or one child for one year? Obtaining unit cost information is important to a broad set of program planners and implementers, including the Government of Ghana. Answers to the question will feed into the development and costing of the next five-year National Strategic Framework. It will also provide important input for writing the country's Global Fund Round 10 application, which is expected to focus on care and treatment.

⁴ The Food by Prescription program was not operational at the time of the study. Officials expect to begin the program in the latter half of 2010.

⁵ However, if counseling and testing is directed to patients already enrolled in an ART program, it is considered as part of the program to be costed.

How might normative costs differ from actual unit costs? Normative costs derive from standard service guidelines. Actual costs emerge from real-life practices. Most cost studies find some differences between the two.

How might unit costs vary according to the level of care facility? Ghana's clinical care and treatment program provides care at teaching, regional, and district hospitals. Important differences may exist in unit costs according to facility levels.

How might unit costs vary between low- and high-prevalence areas of the country? Unit costs may differ by region or district depending on variations in demand for ART, which in turn reflects differences in underlying HIV prevalence. For example, high-prevalence areas with high demand may generate economies of scale in the provision of care and thus result in lower unit costs.

How might unit costs vary according to whether a site is public, private for-profit, or mission? Important differences may exist in unit costs at facilities grouped under these broad ownership categories.

How might unit costs vary as the program scales up? This may be an important question if particular program elements are not yet scaled up nationally. Cost analysis can help determine whether economies or diseconomies of scale might result from an expanded program. If most services are already at scale, the importance of knowing this diminishes.

How do unit costs vary under different drug regimens? Particularly for ARVs, a change in drug regimen may have a substantial impact on unit costs. Officials are interested in knowing how unit costs might vary with different drug regimens.

What are the projected total national costs over the next five years, taking into account demographic and epidemiological data? The Goals Model responds to this question. It combines unit cost data with the demographic and epidemiological data in the Spectrum System of Policy Models to calculate national costs for scaling up the program at set levels of coverage.

STUDY PERSPECTIVE

The choice of study perspective determines the scope of the costs and benefits to be analyzed. Ideally, any economic analysis should adopt the perspective of society and include all effects and all related costs regardless of who benefits from or who pays the costs. More practically, a cost analysis should reflect the perspective of the persons or institutions that are most affected by the outcome of interest and bear certain costs associated with the program. Moreover, the choice of study perspective should be consistent with the ranking of the study audiences. From the perspective of the government—the study's most important audience—it was important to collect information on both the financial and economic costs of the program (including, for example, the cost of volunteer labor). Similarly, it was not necessary to collect information on costs to society as a whole (for example, cost of client waiting time).

TIMEFRAME AND ANALYTIC HORIZON

For any study, the time frame (the period over which the program is carried out) and the analytic horizon (the period of interest during which costs and outcomes occur as result of the program) should be sufficiently long to capture all relevant positive and negative program effects. For this study, we defined both the time frame and analytic horizon as one year.

STUDY METHODOLOGY

Costing Approach

In accordance with one of the standard analyses used in costing ART programs, the study focused on unit cost analysis, which is defined as the cost of caring for one client for one year. The general approach was bottom-up; that is, it included the factors involved in costing the direct costs of each intervention combined with elements of top-down costing to obtain some direct and most indirect costs. The approach considered the HIV clinical care and treatment program as a system that transforms inputs into outputs through processes or actions. The outputs lead to changes that bring about outcomes—what the program is ultimately trying to achieve (see Annex 3).⁶ The systems approach helps ensure that the analysis captures the full range of inputs, defined as anything the program needs to function to produce the desired outputs. Inputs include, for example, labor (health workers, administrative staff, volunteers); supplies (drugs, medical consumables, office materials, promotional materials); and capital (medical and office equipment, buildings, land, vehicles). Valuing these inputs (that is, putting a cost or price on them) is the heart of the study.

Sample

In determining where to collect data, the study team used as a starting point the 138 sites that were providing ART services in Ghana as of December 2009. The team debated the merits of collecting data from a random sample of sites versus from a purposive sample (i.e., a sample selected in a non-random fashion to achieve certain goals of representation). To make sure that the study was completed rapidly, at a relatively low cost, and was reflective of regional and operational variation, the team opted for a purposive sample, selecting sites reflecting the following criteria that may influence unit cost:

- *Level of hospital* (from highest to lowest): Teaching, regional, or district hospital
- *Ownership*: Government, mission, or private for-profit
- *Location within the country*: Inclusion of the country's three main agro-ecological zones of savannah, forest, and coastal
- *HIV prevalence in facility catchment area*: A range of low to high within the Ghanaian context

The study team first chose regions and then within each region identified the associated regional and district hospitals for inclusion in the study. Based on the above criteria, the team selected 15 sites (see Table 5), including both of the country's 2 teaching hospitals, 4 of its 10 regional hospitals, and 9 of its 126 district hospitals providing HIV clinical care (see Table 6).

⁶ For more on systems analysis, see Janowitz and Bratt, 1994.

Table 5. Sites Included in Study by Region, Location, HIV Prevalence, Level of Hospital, and Ownership

Region	Location	HIV Prevalence	Level of Hospital	Ownership
Greater Accra	Coastal	Medium	1 Teaching 1 Regional 3 District	4 Public 1 Private for-profit
Ashanti	Forest	Medium	1 Teaching	1 Public
Eastern	Forest	High	1 Regional 1 District	1 Public 1 Mission
Brong-Ahafo	Forest	Medium	1 Regional 3 District	1 Public 3 Mission
Upper West	Savannah	Medium	1 Regional 2 District	3 Public

Source: Authors.

Table 6. Sites Included in Study by Level of Facility and National Total Sites Providing HIV Clinical Care and Treatment

Level of Facility	Number in Study	Total Number Providing HIV Clinical Care and Treatment (December 2009)
Teaching hospital	2	2
Regional hospital	4	10
District hospital	9	126
Total	15	138

Source: Authors.

Types of Inputs Costed

A full costing of all inputs gives decisionmakers the best sense of true unit costs. Thus, the study team included any input it determined to be critical to the successful operation of Ghana's clinical care and treatment program.⁷ Costed inputs include the following, organized according to direct and indirect costs⁸ (Annex 3 provides a full description of costing methods):

Direct costs

- Staff time in caring for clients
- Drugs to prevent and treat opportunistic infections
- ARV drugs
- Medical consumables and supplies used for clinic visits
- Laboratory testing
- Medical equipment
- Vehicles used directly for client care
- Physical infrastructure used for client care

⁷ Consistent with the discussion of study perspective, the study did not include client out-of-pocket costs or other social costs in the analysis.

⁸ Direct costs are those resources explicitly identified with a service or product. Indirect costs cannot be directly identified with a service or product—rather they are the costs of supporting the direct activities.

Indirect costs directly associated with the clinical care program at the facility level

- Administrative staff time
- Supervision from regional or central level
- Office equipment
- Vehicles used for program administration
- Physical infrastructure for program administration
- Transport costs for administration
- Public utilities (electricity, water, and so forth)
- Maintenance and repair
- Staff training
- Other administrative costs (office supplies, legal costs, audit, maintenance and repair)

Indirect costs for general program support

- General program support from the national ART program
- General program support from national health authorities

Costs Not Included in the Analysis

In accordance with the study perspective mentioned above, the study did not include the following:

- Costs to program clients such as client time, transport, meals, out-of-pocket payments, user fees for services or drugs, and so forth. An analysis of these costs is planned as part of the upcoming 2010 National AIDS Spending Assessment.
- Costs incurred by local communities (other than volunteer time directly associated with service provision).
- Negative externalities (such that they exist) associated with the program.
- Technical assistance or administrative costs incurred by external donor agencies.

Valuing the Inputs

As a general rule, the value of an input should reflect its economic (opportunity) cost. In most cases, the economic cost is the same as the financial cost (the amount somebody paid for an input). In other cases, the economic cost differs if the input was not purchased at market price (for example, donated drugs or volunteer labor). The study aimed to identify both the financial and market costs of inputs (where a difference may exist). For donated or subsidized inputs, the study estimated market prices.

The study valued inputs in local currency—Ghana cedi (GH¢) or US\$ as appropriate—and reports the results in both currencies, using average exchange rates for the relevant time periods.⁹ To adjust for inflation, the study reports all costs in constant 2010 prices.¹⁰

Data Collection and Processing

The team developed a standard questionnaire to collect data from the sample of 15 facilities. The team pre-tested the questionnaire at one site and then used it to train facility data collection teams. Under the supervision of the Health Policy Initiative consultants, data collection teams traveled to the 15 facilities between April 26 and May 21, 2010 (see Annex 2). They interviewed local program officials, reviewed program and facility documents, and administered the questionnaire. Throughout the data collection

⁹ Exchange rate of GH¢ 1.42 per US\$1.

¹⁰ According to the Bank of Ghana, consumer prices increased by 19.3 percent in 2009 and are projected to increase by 10.6 percent in 2010.

period, the consultants gathered information from central sources on resource use and prices, drawing from a variety of local sources (see Annex 3). Consultants began cleaning and entering data immediately upon completion of field work, using a Ghana-specific data entry and analysis template in Excel adapted from other costing tools, including the USAID-funded CORE+ model (MSH, 2010). The template includes one workbook for each facility, a workbook containing standard national price information, and a workbook that consolidates the data for analysis.

Study Limitations

One overarching limitation of the study was the nonrandomized selection of study sites, which introduced an element of uncertainty in the extrapolation of results to the national level. One factor mitigating the problem was the study's inclusion of sites serving almost 70 percent of all clients enrolled in the clinical care and treatment program. Another limitation was the relatively small sample size, which precluded tests of statistical significance when comparing groups of sites such as teaching, regional, and district hospitals.

Although data collection teams administered a standard questionnaire at each site, the quality and completeness of the data was not uniform across sites. Data collection teams attempted to contact and interview persons most knowledgeable about program operations. However, responsibility for the program is typically scattered across various persons and departments within sites. Given the limited time available at each site, data collection teams were not always able to locate and interview key informants and thus were unable to collect data on some of the facility-wide indirect costs shared by the ART program, such as the cost of public utilities, maintenance and repair, and transportation. As the results below indicate, these inputs were all relatively minor contributors to overall unit cost; as a result, any underestimate of unit cost arising from absent information is probably minimal.

Beyond data collection issues, the clinical care and treatment program varies in significant ways across sites. Some sites operate in freestanding facilities that provide services daily and clearly delineate the responsibilities of staff members. Other sites provide services in a more integrated way or designate particular days or hours for the provision of clinical care. In addition, sites do not all see the same type of client. The teaching and regional hospitals tend to see clients with complicated HIV-associated problems while district hospitals typically see clients with fewer problems. Further, the number of clients differs dramatically, ranging from under 100 at some district hospitals to more than 10,000 at the country's main teaching hospital. The diversity of the sites along these dimensions complicated the application of a single standard questionnaire as well as the interpretation of results.

Another limitation was that much of the data on resource use was based on estimates or best guesses. Among the most important data elements were the amount of staff time consumed in the typical client visit and the average number of visits made by the typical client during a year. Although all sites had information on the number of clients enrolled in the program, few kept accurate data on the number of visits made by clients in a year. These estimates could introduce errors into the cost results.

At many of the 15 sites, the study team also encountered problems in collecting and interpreting facility-level data on OI drugs and laboratory testing. Some sites reported types of laboratory testing but lacked accurate information on frequency of testing because of the great variety of client types and their testing needs. Other sites reported total number of tests carried out in the year for all clients at the site. Interpretation of the information posed a challenge because of how sites operate. For example, some sites may report relatively low numbers of tests per client if clients enroll in the program at one site but receive services at another site or sites. Conversely, sites may treat clients who initially enroll elsewhere. Both instances generate higher or lower levels of laboratory use. Similar problems hampered the collection and interpretation of data on drug use for prevention and treatment of opportunistic infections. In

combination, the various methodological difficulties in data collection, analysis, and interpretation argued for use of the national service guidelines on the type and frequency of testing and OI drug prescription as the basis for the cost calculations. A subsequent study could potentially collect more in-depth information on *actual* use of laboratory services.

RESULTS

This section discusses results, with a focus on unit cost (cost per year per adult and pediatric client). Where appropriate, the results are shown by national average, individual sites, and sites grouped by categories of level of ownership, geographic region, and HIV prevalence zone.

Unit Costs of HIV Clinical Care

The most representative indicator of national costs is an average across the 15 sites weighted by the number of clients served at each facility. Application of the weighted average yields an average cost per client per year of GH¢ 758 (US\$534), almost 20 percent lower than the unweighted arithmetic mean of GH¢ 929 (US\$655) (see Figure 1). The weighted average is lower because sites with the highest client loads generally incur lower unit costs (see Table 7).

Figure 1. Cost per Year per Adult Client, National Average

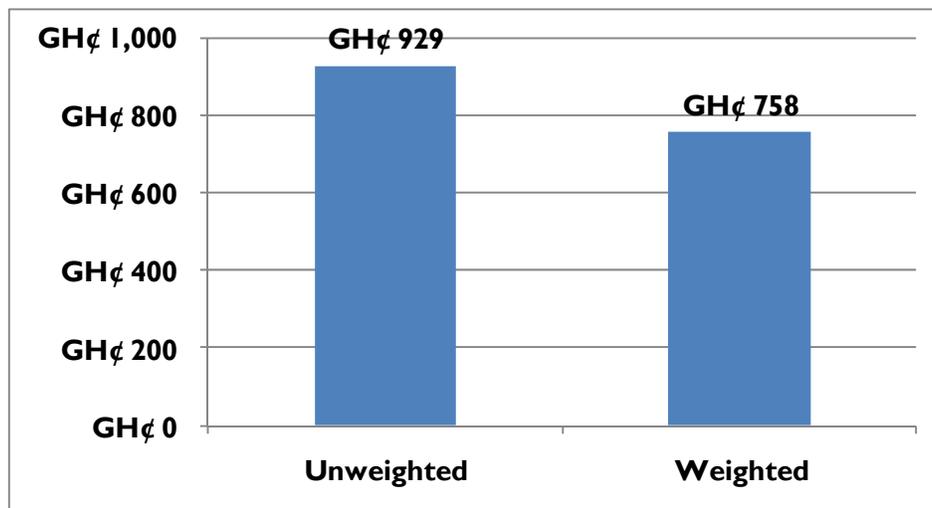


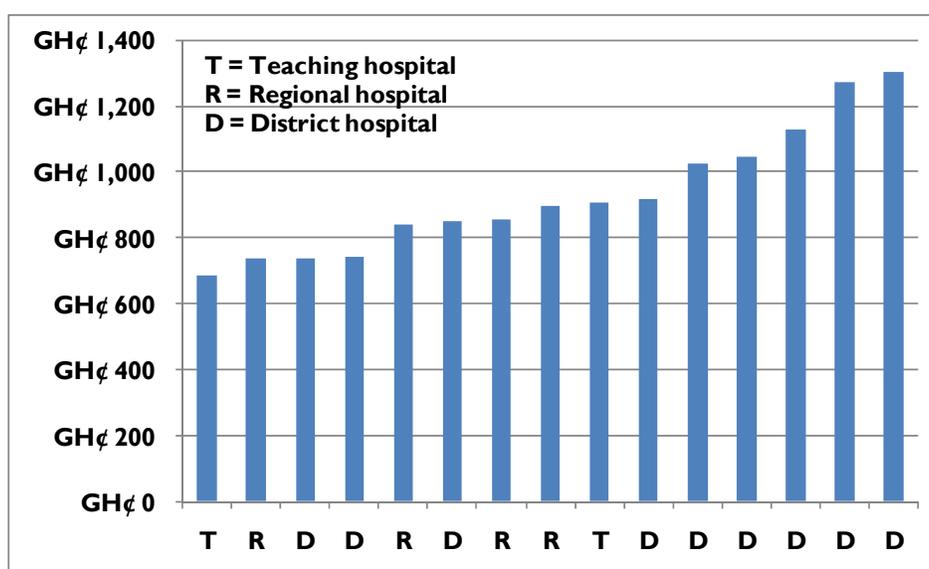
Table 7. Unit Cost and Number of Clients by Facility

Level of Facility	Cost per Year		Number of Clients
	Cedis	US\$	
Teaching	GH¢ 683	\$482	14,320
Teaching	GH¢ 904	\$638	935
Regional	GH¢ 736	\$519	2,500
Regional	GH¢ 838	\$591	799
Regional	GH¢ 855	\$603	1,172
Regional	GH¢ 895	\$631	2,389
District	GH¢ 738	\$520	435
District	GH¢ 743	\$524	3,419
District	GH¢ 850	\$599	255
District	GH¢ 915	\$645	833
District	GH¢ 1,023	\$721	279
District	GH¢ 1,045	\$737	91
District	GH¢ 1,128	\$795	291
District	GH¢ 1,274	\$898	241
District	GH¢ 1,303	\$918	76
Total	GH¢13,930	\$9821.00	28,035

Source: Authors.

The national averages mask considerable variation among the 15 sites. The cost per year per client ranges from GH¢ 683 to GH¢ 1,303 (US\$482 to US\$918) (see Figure 2). Many district hospitals are on the higher end of the cost range while the teaching and regional hospitals tend toward the lower end.

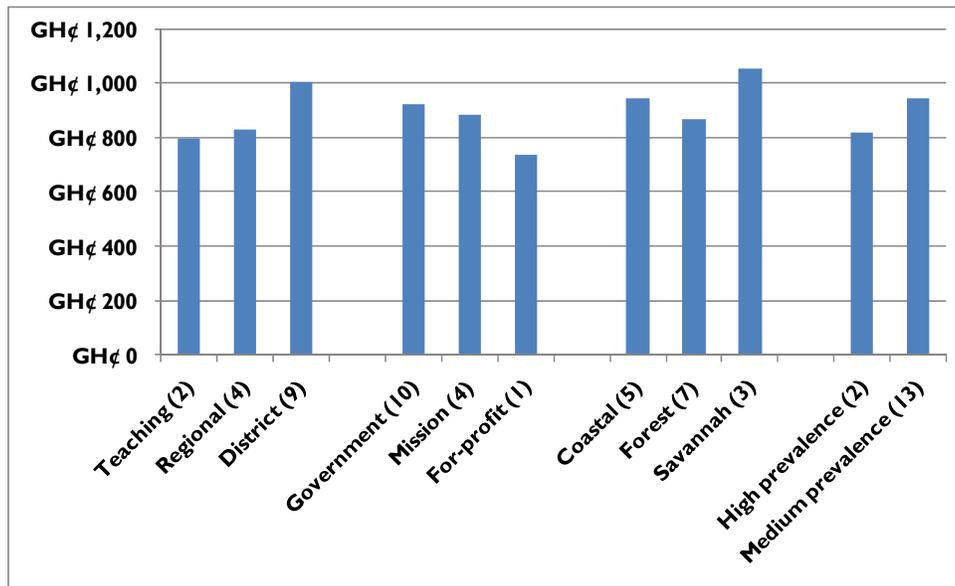
Figure 2. Variation in Unit Cost by Facility



Unit costs by facility characteristic

When grouping facilities according to key characteristics likely to influence unit cost outcomes, the study found some substantial variation, particularly when sites are grouped by level (see Figure 3).

Figure 3. Variation in Unit Cost by Key Facility Characteristics

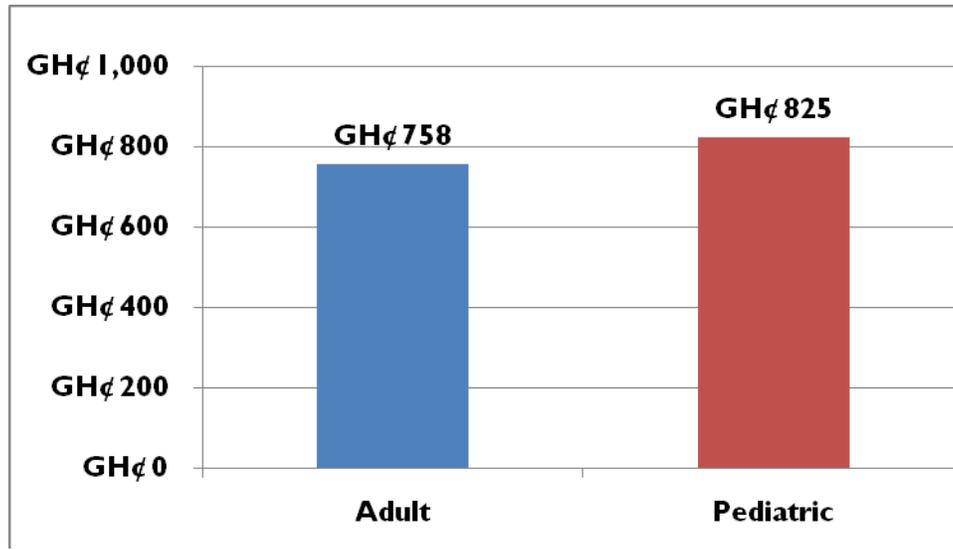


The 2 teaching hospitals and 4 regional hospitals had, on average, similar unit costs of GH¢ 794 and GH¢ 831 (US\$560 and US\$586), respectively. By contrast, unit costs at the 9 district hospitals were about 25 percent higher, averaging GH¢ 1002 (US\$706). The 10 government facilities accounted for the highest unit costs on average at GH¢ 921 (US\$649) compared with GH¢ 883 (US\$622) at the 4 mission hospitals and GH¢ 738 (US\$520) at the single private for-profit hospital. Average unit cost in the 5 coastal region facilities was GH¢ 941 (US\$664) versus GH¢ 867 (US\$611) in the 7 forest region sites and GH¢ 1,052 (US\$742) in the 3 savannah region facilities. Average unit cost in the 13 facilities in areas of medium HIV prevalence (between 1.1 and 3.0%) was GH¢ 946 (US\$667) versus GH¢ 819 (US\$577) in the 2 facilities in areas of high HIV prevalence (> 3.0 percent).

Cost of clinical care for pediatric clients

For the most part, the study found only minor differences in the types, amount, and price of resources used for the care of children as compared to the care for adults. Laboratory costs for children were slightly lower, and costs of OI drugs were slightly higher. The major difference was in cost of ARV drugs, which are almost 40 percent higher for children than for adults. As a result, total cost per year for a pediatric client was GH¢ 825 (US\$582), about 10 percent higher than for adults (see Figure 4). When examined by the various groupings above (level of care and so forth), the study discovered that costs for pediatric care vary in the same way as costs for adults (not shown).

Figure 4. Comparison of Adult and Pediatric Unit Cost



Direct and indirect costs

The analysis permitted an examination of the program’s cost structure, including a breakdown by direct and indirect costs. Direct costs are those resources explicitly identified with HIV clinical care services and include inputs such as the time spent by health workers in direct contact with clients; drugs and medical supplies used in clinical treatment and care; and medical equipment. Indirect costs cannot be directly identified with a service and instead are the costs of supporting direct activities, including resources such as administrative staff, other general administrative costs, and support from the national clinical care and treatment program. Overall, as Figure 5 shows, costs were split 63 versus 37 percent between direct and indirect costs, respectively, with the split fairly stable across facilities and by major groupings (see Annex 4). The following sections discuss some of the major cost components of direct and indirect costs.¹¹

¹¹ All figures cited are for adult clients, unless otherwise noted.

Figure 5. Distribution of Direct and Indirect Costs

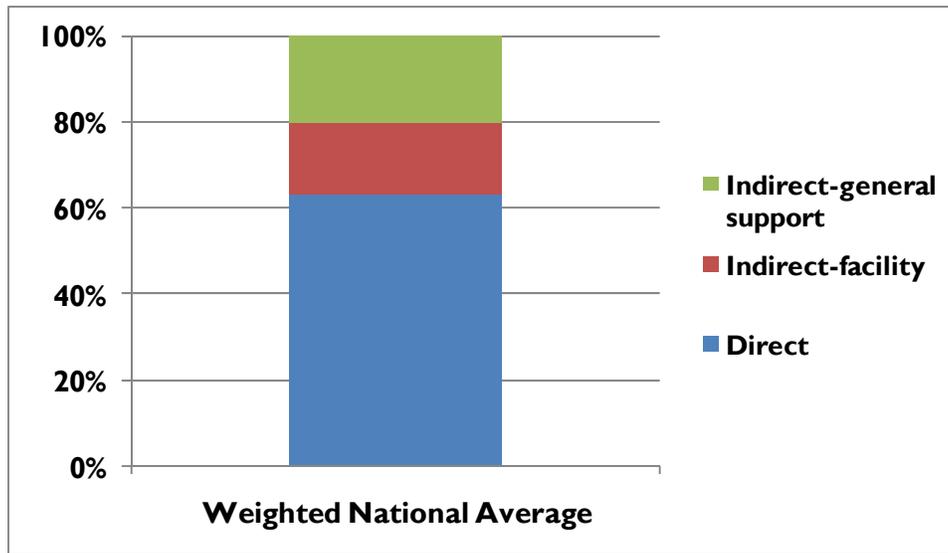
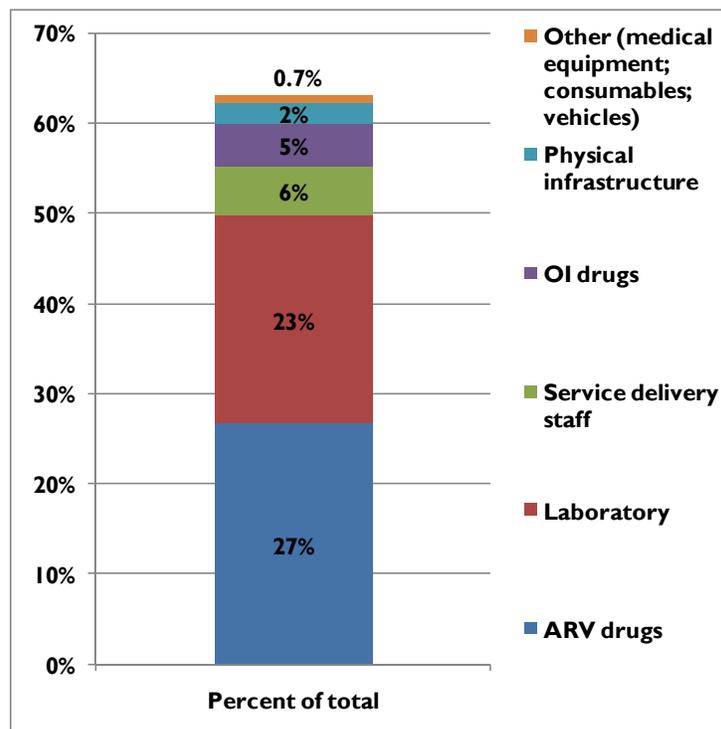


Figure 6 shows the major elements of direct costs as a proportion of total program cost.

Figure 6: Direct Costs as a Percent of Total Costs, by Major Category



Antiretroviral drugs

As expected, ARV drugs are one of the largest cost components of care, comprising 27 percent of total cost on average or GH¢ 202 (US\$143). Given that accurate figures on drug regimen were not available by site, the study drew on national data to calculate the annual cost per client and assumed the data were uniform across facilities. The ARV drug cost is calculated as a weighted average of the cost of the various

drug regimens that the program prescribes to adults. The cost differences, when broken out by first- and second-line treatment regimens, are substantial (see Table 8). For adults, the cost of first- and second-line treatment averages, respectively, GH¢ 182 (US\$128) and GH¢ 1,450 (US\$1,021). Yearly ARV costs for children are higher than for adults for first-line regimens at GH¢ 263 (US\$185), but lower for second-line regimens at GH¢ 507 (US\$357). The weighted average cost of ARVs for children is GH¢ 280 (US\$197).

Table 8. Yearly Cost of ARV Drug Regimens, 2010 (US\$)

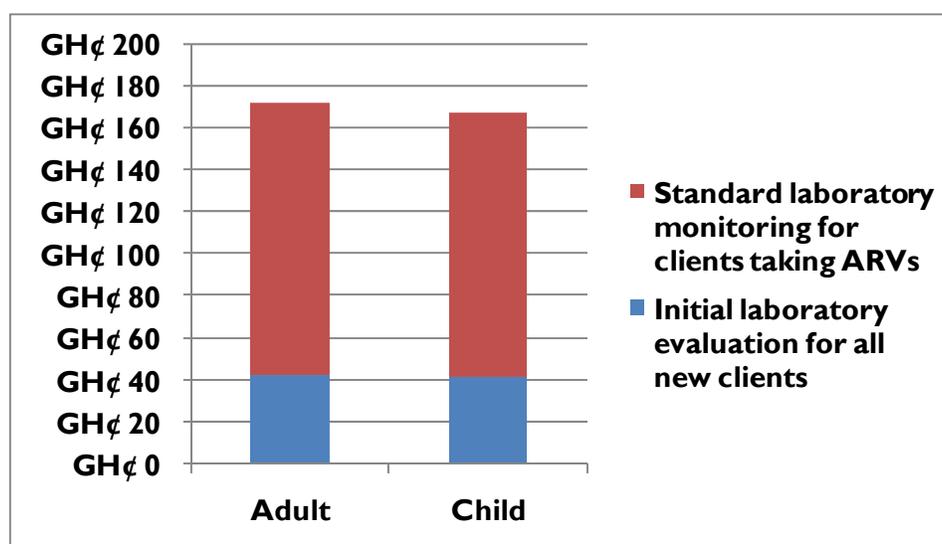
	Annual Cost	Percent of Clients on Regimen
Adults		
First line	\$127.63	98%
Second line	\$1,021.18	2%
Weighted average	\$142.72	100%
Children		
First line	\$185.06	93%
Second line	\$357.45	7%
Weighted average	\$197.24	100%

Source: Authors, based on NACP data.

Laboratory testing

Laboratory work is another major cost component, averaging 23 percent of total cost or GH¢ 174 (US\$123) (Figure 7)¹² and reflecting the large number and frequency of tests that the typical patient undergoes both upon enrolling in the program and in subsequent months and years. About one-fourth of the cost is for the initial laboratory evaluation for a new client; the remaining three-fourths reflects the yearly cost of clients who remain in the program. Minor differences in protocols for laboratory testing mean that the annual cost of laboratory testing for children was slightly lower at GH¢ 165 (US\$117).

Figure 7: Costs of Laboratory Testing



¹² Because viral load testing is not standard in Ghana, it was excluded from the cost calculation. A viral load test at the national teaching hospital in Ghana costs GH¢ 120 (US\$85).

Health workers

Health workers who care directly for clients account for 6 percent of total cost or GH¢ 42 (US\$30) per year. The average, however, conceals particularly wide variation in the yearly cost reported at the facility level—from GH¢ 7 to GH¢ 175 (median GH¢ 48 or US\$34). Some of the variation is attributable to differences in the categories of health workers delivering health services (i.e., doctors versus nurses). Other variation is attributable to the amount of time that health workers estimate as spending with clients; even more variation may result from differences in what facility staff estimate as the average number of visits made by clients in a typical year. Six of the 15 sites report that they provide health workers in the ART program with special incentives—such as a free lunch or an extra payment per ART clinic day—beyond their standard salary. In 3 of the 6 sites offering staff incentives, the incentives make up less than 3 percent of direct staff costs. However, in the remaining 3 sites, incentives account for a considerable added cost of between 6 and 18 percent of direct staff costs.

Drugs for preventing and treating opportunistic infections

Such drugs were estimated to account for 5 percent of total cost or GH¢ 35 (US\$25) per client per year.

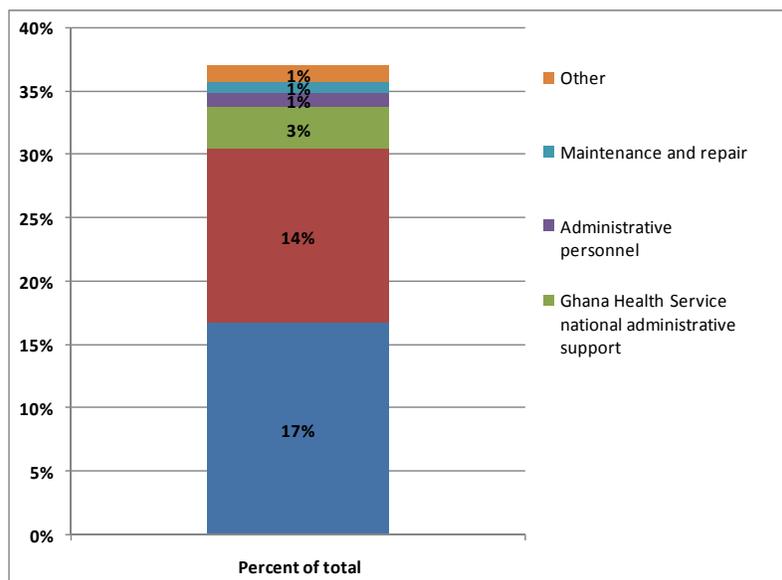
Physical infrastructure

The physical infrastructure is another fairly significant component of direct costs, accounting for 2 percent of total cost or GH¢ 18 (US\$13). Infrastructure, however, also exhibits wide variation across facilities from GH¢ 1 to GH¢ 168 (US\$1 to US\$118) per year per client. That the infrastructure cost was based in part on facility staff estimates of the percentage of a space dedicated to the clinical care program may account for some of the variation in cost per client. Other factors also appear to be important. Facilities with stand-alone space for HIV clinical care likely to incur higher cost per clients, and facilities with higher client loads are able to spread infrastructure costs across a greater number of clients and thus lower the cost per client.

Other direct costs

Costs such as for medical equipment, medical consumables and supplies, and vehicles used directly for service delivery accounted for less than 1 percent of total cost. Figure 8 shows the major elements of indirect costs as a proportion of total program costs.

Figure 8: Indirect Costs as a Percent of Total Costs, by Major Category



General support costs of the national ART program were the largest component of indirect costs, accounting for 14 percent of total cost or GH¢ 127 (US\$90) per client per year. The cost calculations were based on the NACP’s national totals for various administrative and support items and allocated equally per client by using the national total for the number of clients enrolled in the HIV clinical care program. Thus, the absolute amount allocated per client did not vary across facilities, but the relative proportion varied, ranging between 10 and 19 percent.

Training costs represented the next-greatest contributor to overall cost at an average 14 percent of the total or GH¢ 103 (US\$73) per year. Training costs included data collected at the facility level on facilities’ cost of training and national totals on training, allocated per client similar to the calculation for general support costs of the national ART program. Because facilities reported relatively few locally funded trainings, overall training costs varied only slightly across facilities.

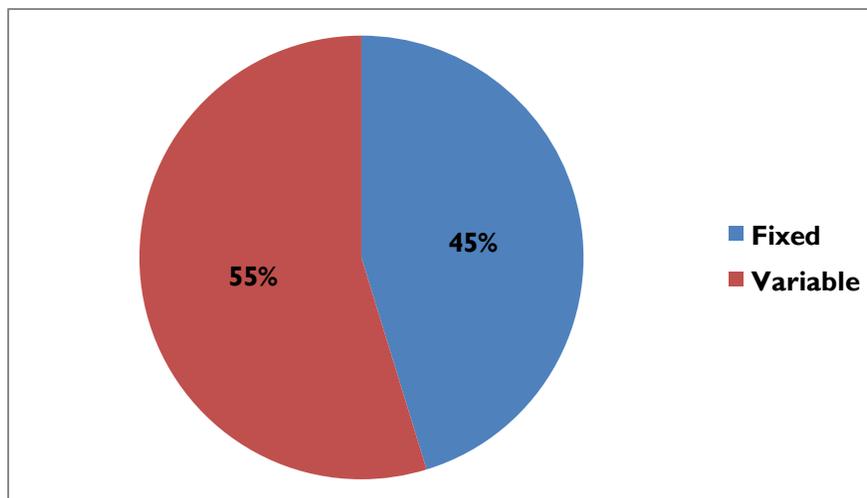
General support costs of the Ghana Health Service are the third significant element of indirect costs, accounting for 3 percent of total cost or GH¢ 25 (US\$18) per client per year. With support costs calculated per visit, we observed some variation across facilities. Facilities with relatively low numbers of visits per client per year incurred fewer costs. Cost per year per client varied between GH¢ 10 (US\$7) and GH¢ 74 (US\$52) (median GH¢39 [US\$27]).

Other indirect costs account for the remaining 3 percent of total cost and include items such as administrative staff at the facility, supervision, office equipment, administrative vehicles, administrative physical infrastructure, transportation, and maintenance and repair of buildings and equipment.

Fixed and variable costs

Another way to examine the structure of the HIV clinical care and treatment program is by fixed and variable cost—an analysis that provides insights into how unit costs might vary as the program scales up. Variable costs are those that change in the short term with the quantity of services offered, including inputs such as drugs, tests, and clinical supplies. Fixed costs are those that do not change in the short term when service quantities change and include staff time, facility operating costs, and support costs. As Figure 9 shows, total costs for the program are split roughly equally between fixed and variable costs, with fixed costs representing 45 percent of total cost and variable costs 55 percent. The proportions of fixed and variable costs are roughly similar across level of facility, ownership type, geographic region, and HIV prevalence zone.

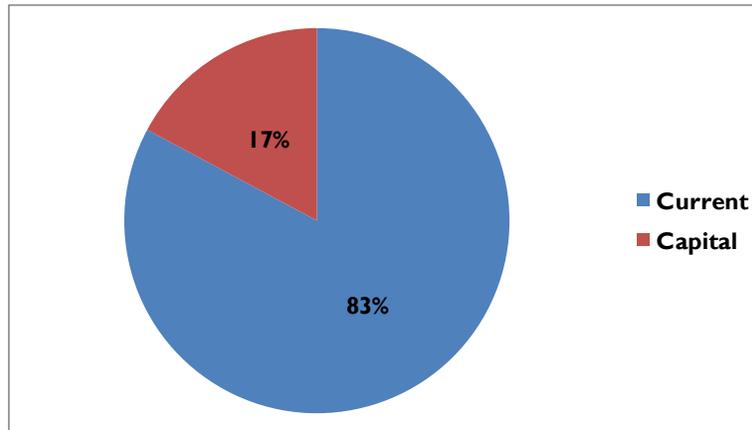
Figure 9. Distribution of Fixed and Variable Costs



Current and capital costs

Current costs include items that are consumed immediately in the course of providing a service or that have a useful life of less than one year. Capital goods are those items that have a useful life of longer than one year. As Figure 10 shows, current costs account for 83 percent of total cost and capital costs for just 17 percent. The proportions are relatively stable across facilities and by facility grouping.

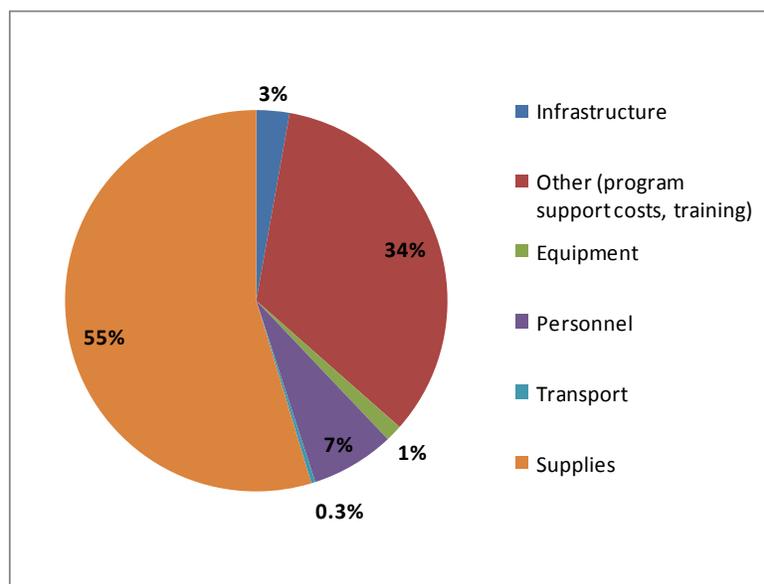
Figure 10: Distribution of Current and Capital Costs



Costs by type of input

Another way to think about costs is in terms of types of input grouped broadly in categories of personnel, transport, equipment, supplies, infrastructure, and other (including general support costs and training). As Figure 11 shows, supplies represent the largest proportion of total costs at 55 percent of the total, reflecting the relatively large role played by ARV drugs and laboratory testing in overall costs. The next-largest share of costs is program support and training at 34 percent. Personnel costs in a typical health program are the chief cost driver. In the case of the HIV clinical care and treatment program, however, they contribute only a relatively minor portion of overall costs at just 7 percent, due to the relatively high cost of ARVs and laboratory tests for AIDS care.

Figure 11: Costs by Type of Input



Financial and economic costs

The study valued inputs at their economic (market) cost whenever possible. With few exceptions, the economic cost of an input to the HIV clinical care and treatment program was the same as its financial cost (the amount somebody paid for it). One exception was physical infrastructure. The national care and treatment program does not pay outright for the building and clinic space at each facility. Nonetheless, the study team assigned an imputed rental cost to the space, which, on average, totaled 3 percent of weighted total costs. Another input with potentially different economic and financial costs is volunteer time. Eight of the 15 sites relied on volunteers, typically people living with HIV & AIDS who work as peer educators. Almost all volunteers received some compensation in the form of either a direct stipend or a subsidy for travel and meals. The financial cost of volunteers (what is paid out to them) is roughly the same as an imputed economic cost that uses the current official daily minimum wage of GH¢ 3.11 (US\$2.19) as a standard. Interestingly, at some sites, volunteer costs make up a substantial proportion of direct service delivery staff costs—23 percent in one district hospital, 10 percent in one regional hospital, and 9 percent in one teaching hospital. At other sites, however, volunteer costs are less than 5 percent of overall direct staff costs.

Sensitivity Analysis

The results of any cost study depend to a significant extent on the assumptions used in calculating costs. It is therefore important to determine whether changes in assumptions might substantially alter a study's findings. Sensitivity analyses are used to determine the effect of changed assumptions. We carried out sensitivity analyses based on selected assumptions that were determined in the course of data collection and analysis. Sensitivity analyses produce upper and lower bounds on the unit cost figures discussed above. Table 9 shows the most important study assumptions and modifications of the assumptions in the sensitivity analysis.

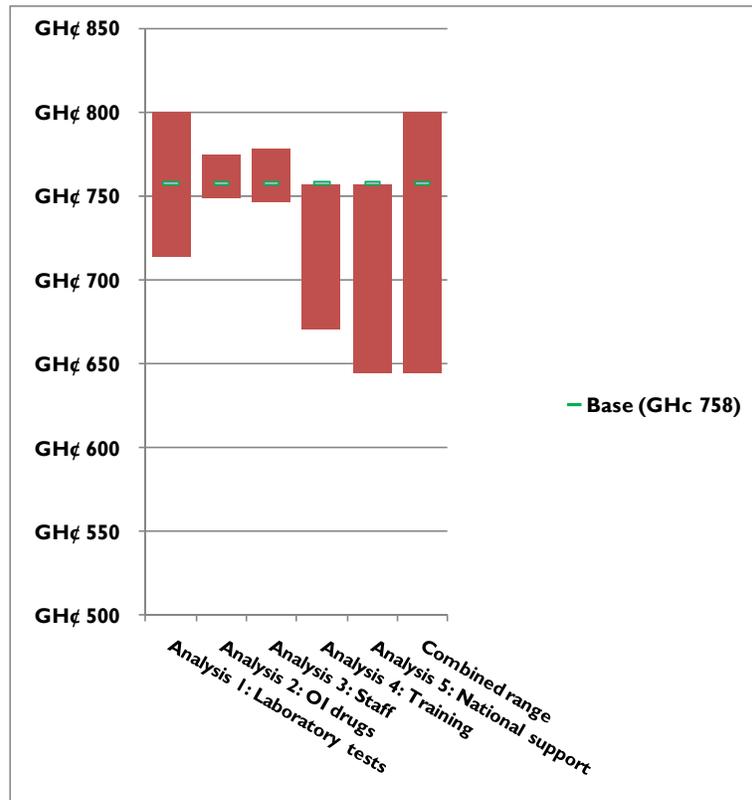
Table 9. Sensitivity Analyses

Base-Case Assumption	Modification of Assumption for Sensitivity Analysis
Analysis 1: Laboratory costs based on reimbursement by National Health Insurance System (NHIS)	Reduce prices by 25% Raise prices by 25%
Analysis 2: Costs of drugs for prevention and treatment of opportunistic infections based on reimbursement by National Health Insurance System	Reduce prices by 25% Raise prices by 50%
Analysis 3: Staff time use based on estimates from interviews	Reduce by 25% Raise by 50%
Analysis 4: National training costs allocated per client	Allocated per site
Analysis 5: National ART program support costs allocated per client	Allocated per site

The first two sensitivity analyses reflect a degree of uncertainty in the prices assigned to laboratory tests and to drugs for prevention and treatment of opportunistic infections. The team recalculated the average unit cost based on a price range either 25 percent lower than our base-case estimate or 25 percent higher (50% higher in the case of drug prices). The third sensitivity analysis reflects uncertainty in the estimate of staff time in direct care of clients. The team recalculated the average cost, assuming that the real level of staff time is either 25 percent lower or 50 percent higher than our base-case estimate. The fourth and fifth sensitivity analyses recalculated unit costs after modifying our base-case assumption that national training and ART support costs should be allocated not per client but rather per site.

As Figure 12 shows, unit costs vary only slightly under sensitivity analyses 2 and 3. Under sensitivity analysis 1, the changed price assumption for laboratory testing produced a unit cost estimate range between GH¢ 714 and GH¢ 801 (US\$503 to US\$563). Under analyses 4 and 5, the allocation of costs per site decreased the unit cost from the base case of GH¢ 758 (US\$534) to GH¢ 671 and GH¢ 645 (US\$473 and US\$455).

Figure 12. Range of Unit Cost Estimates Under Sensitivity Analyses



Combining the low and high estimates from the analyses, the range varied from a low of GH¢ 645 (US\$473) to a high of GH¢ 801 (US\$563). Compared to the base-case estimate, the results provide a lower bound about 15 percent lower and an upper bound about 5 percent higher. It is also interesting to note that allocating the training and national support costs per site rather than per client increases the average cost of the district sites while decreasing the cost of the teaching and regional sites (not shown).

Scale Effects on Unit Cost

In considering expansion of Ghana’s HIV clinical treatment and care program through either increased provision of services at existing sites or establishment of new clinical care sites, the study shows that the program’s cost structure provides some general indication of whether unit costs might increase or decrease.

One main influence on the behavior of unit costs during program expansion is that fixed costs account for almost half of total program costs. If expansion occurs by attracting greater numbers of clients to existing sites, the program will be able to spread costs over a larger pool of beneficiaries, thus driving down unit costs. In fact, unit costs could potentially be driven down even further if the growth in client loads is concentrated at those district-level facilities with currently lower client loads and higher unit costs. Unit

costs at such sites are likely to approach those of the currently lower unit costs of regional and teaching hospitals.

By contrast, expansion of the program through establishment of new clinical care sites will likely drive up average unit costs nationally, at least initially. This is because almost all new sites would be located at district hospitals, which the study showed to have considerably higher costs per client (see Figure 2 in the Results section). However, one factor potentially mitigating such projected increases in unit costs is that an expanded number of clinical sites would permit the national program to spread some of its relatively fixed administrative costs over a program serving more clients, thus realizing economies of scale and cost savings. However, some of the savings may be offset by additional upfront expenses in establishing the program in a new geographic area and the extra personnel and communication costs associated with long-distance management.

Normative versus Actual Costs

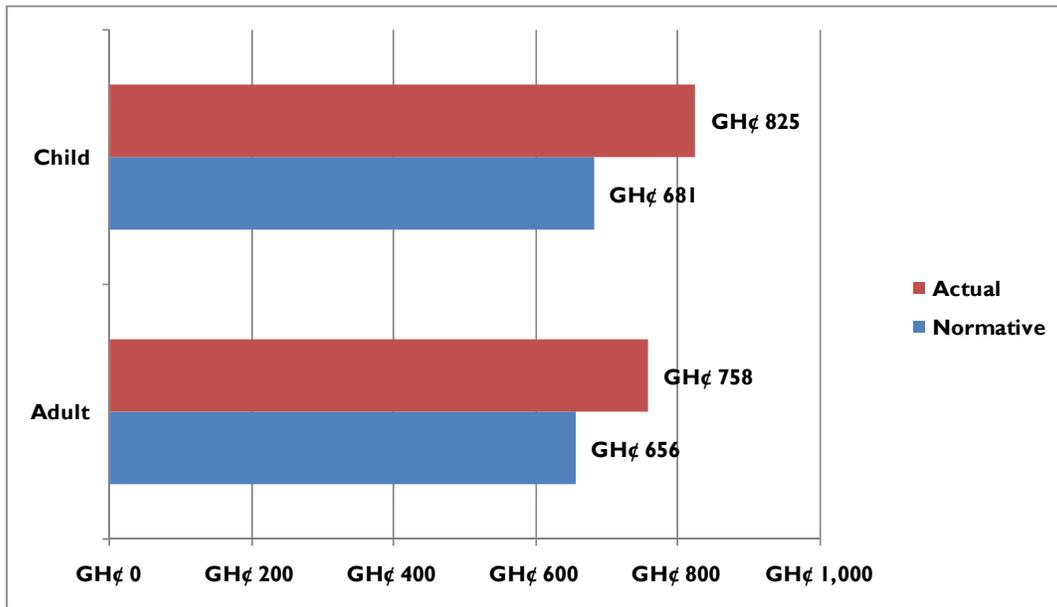
Normative costs derive from resource amounts (labor, drugs, and so forth) that emerge from standard service guidelines. Actual costs emerge from real-life practices that the study attempted to capture through data collection at facilities. Most cost studies find significant differences between normative and actual costs. We calculated normative costs for the Ghana care and treatment program by using the national guidelines for ART and OI care (NACP, 2008a; 2008b) (see Table 10). The cost per year (combining both new and continuing clients) was GH¢ 656 (US\$464) for a typical adult client and GH¢ 681 (US\$480) for a child. Both amounts are about GH¢ 100 lower than the weighted costs reported in Table 10. The apparent difference should, however, be interpreted carefully in light of how the study team calculated the costs. As noted earlier, difficulties in collecting data on actual use made it necessary to use the normative resource values for OI drugs and laboratory testing. Thus, the total for actual costs includes a significant proportion of normative costs. Moreover, one reason that normative costs are lower is because the normative calculation adjusted ARV drug costs downward under the assumption that new clients on average use ARV drugs for only one-half of their first year in the program. These underlying assumptions narrow the differences between actual and normative costs.

Table 10. Normative Cost per Year for HIV Clinical Care, Adult and Children (Cedis)

	Adult			Child		
	New Client	Continuing Client	Weighted Average of New and Continuing Client	New Client	Continuing Client	Weighted Average of New and Continuing Client
Total (cedis)	GH¢ 586	GH¢ 728	GH¢ 656	GH¢ 568	GH¢ 797	GH¢ 681
Comprehensive medical history and physical examination	5.45	--	2.75	5.45	--	2.75
Counseling	5.45	--	2.75	5.45	--	2.75
Initial laboratory evaluation for all new clients	87.15	--	44.02	76.11	--	38.44
Adherence counseling before ARV initiation	16.36	--	8.26	16.36	--	8.26
ARV drugs	51.99	202.43	126.45	45.28	279.75	161.32
Clinical monitoring and follow-up counseling for clients taking ARVs	26.72	25.63	26.18	26.72	25.63	26.18
Standard laboratory monitoring for clients taking ARVs	87.12	174.24	130.24	87.12	167.67	126.98
Prophylaxis for opportunistic infection	14.76	28.94	21.78	15.03	27.37	21.14
OI treatment	10.26	16.23	13.21	10.26	16.23	13.21
Cost per client per year-- indirect costs directly associated with program	128.37	125.21	128.37	128.37	128.37	128.37
Cost per client per year-- indirect general program support costs	152.08	152.08	152.08	152.08	152.08	152.08
Total (US\$)	\$413	\$520	\$464	\$401	\$577	\$480

Source: Authors.

Figure 13: Actual Versus Normative Unit Costs, Adults and Children



Projecting Costs and Impacts

As noted, one of the study's main goals was to provide inputs for modeling the projected costs, coverage, and impact of the interventions associated with Ghana's national HIV & AIDS program through application of the Goals Model (Sanders, 2010). To meet the model's data needs, the team prepared estimates for use as inputs, applying the weighted cost results summarized in Table 11. The data show average unit costs for adult, pediatric, and combined adult and pediatric clinical care. Under the general category of drugs and laboratory services, costs for first- and second-line ARV drugs and for laboratory testing are the same as those used in the unit cost calculations above. The team broke out drug costs for opportunistic infections prophylaxis and treatment separately for prophylaxis and treatment. Under the service delivery category for purposes of the model, the study team calculated a yearly cost of care for a client enrolled in the clinical care program but not yet on ARVs at an average GH¢ 71 (US\$50). The average service delivery cost per visit includes all direct costs other than drugs and laboratory services and all facility indirect costs (including training). The cost per client per year for indirect general program support costs is the same as that estimated in our results above. Because ARV drug costs account for such a large proportion of total cost, changes in ARV drug regimens can have a large impact on unit cost. The Goals exercise also models potential changes in drug regimens, assuming that D4T will be fully phased out of Ghana's adult first line regimens by 2013, replaced by TDF. (For more on use of the inputs in the Goals Model, see Sanders, 2010.)

Table 11. Goals Model Inputs Derived from Costing Study (US\$)

	Adult	Pediatric	Combined Adult and Pediatric
Drugs and Consumables and Laboratory Services			
First-line ART drugs	\$128	\$185	\$129
Second-line ART drugs	\$1,021	\$357	\$946
Laboratory costs for ART treatment	\$121	\$118	\$121
Drug costs for treatment of opportunistic infections	\$9	\$9	\$9
Cotrimoxazole prophylaxis (and other prophylaxis)	\$28	\$33	\$28
Nutrition supplements in first six months	\$0	\$0	\$0
Service Delivery			
In clinical care but not yet on ARVs	\$50	\$49	\$50
Number of out-patient visits annually per person for ART initiation and follow-up	12	12	12
Cost per visit (including facility indirect costs)	\$11	\$11	\$11
Indirect Costs			
National program support costs	\$105	\$105	\$105

Source: Authors.

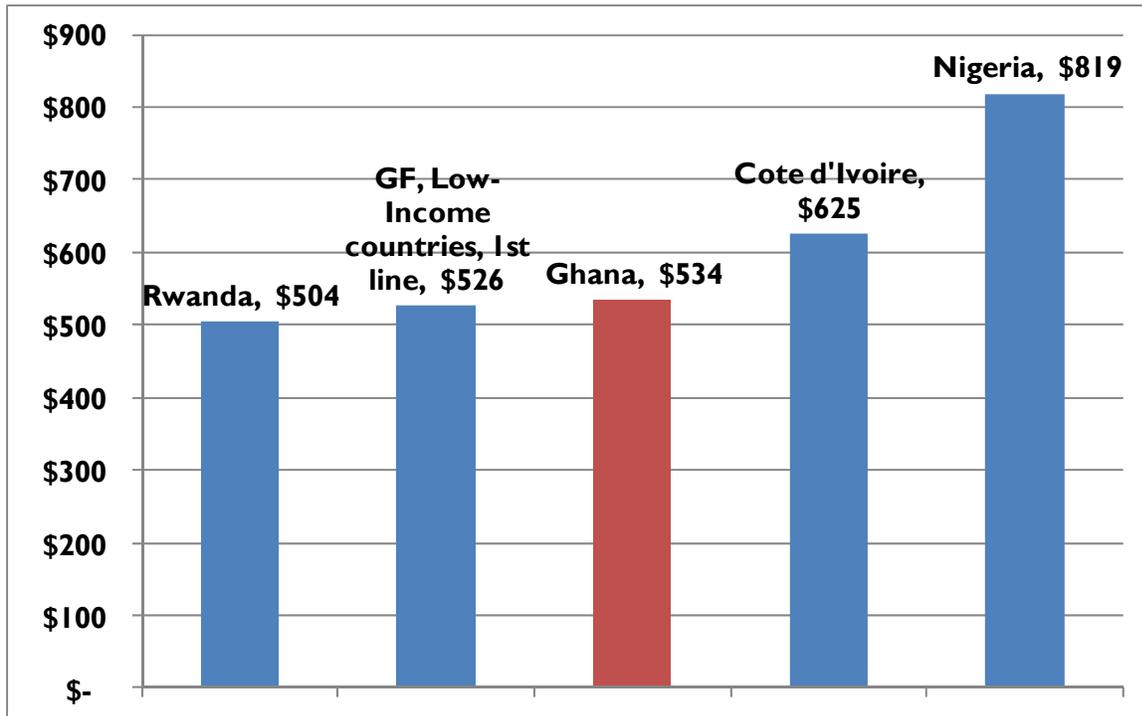
DISCUSSION AND CONCLUSION

The study aimed to provide the Government of Ghana and other audiences with information on the yearly cost of clinical care and treatment for HIV & AIDS clients. The study is one of the first efforts to conduct a comprehensive analysis of the cost of such programs in Ghana. Its results will help inform critical national planning, budgeting, and programming activities currently underway.

In estimating how much it costs to provide clinical care and treatment for one adult or one child for one year, the study set out to ascertain the full cost of caring for clients. The study examined the direct costs associated with clinical care such as staff time, drugs, and laboratory testing and the indirect costs of supporting resources at the facility level and at the national program level. Within the limitations discussed earlier, the study was largely successful in identifying major program inputs, determining the amount of inputs, and assigning a price to inputs. By combining data from established programs at the 15 active sites with information on normative use of resources, the study produced usable results on the cost per client per year at each site for each major type of site and for the national average. The best indicator of national costs is an average of the unit costs of the 15 sites weighted by the number of clients served at each facility. Use of the weighting scheme produced an average unit cost of GH¢ 758 (US\$534) per adult. The cost per year for a pediatric client was about 10 percent higher at GH¢ 825 (US\$582), mainly because of the greater expense in providing ARV drugs to children.

Even allowing for the difficulties that accompany any cross-country cost comparison, the results place Ghana well within the “normal” range of unit costs reported from studies in other countries (see Figure 14).

Figure 14: Cost of One Year of Adult HIV & AIDS Clinical Care, Cross-Country Comparison



Sources: Studies in Table 2.

Consistent with studies from other countries, the two major contributors to cost were antiretroviral drugs (27% of total cost) and laboratory testing (23%). General support costs of the national care and treatment program (17%) and training (14%) were the two most important indirect program costs. Other contributors to costs included service delivery staff (6%), drugs for prophylaxis and treatment of opportunistic infections (5%), and general support costs of the Ghana Health Service (3%).

The study found some variation in outcomes when grouping sites by certain key characteristics thought to influence unit cost levels. The differences were most notable by facility level. Unit costs at the 2 teaching and 4 regional hospitals were about 25 percent lower than costs at the 9 district hospitals, largely reflecting higher client loads at teaching and regional hospitals compared with district hospitals. The higher client loads allow ART clinics to spread some fixed program costs across a much larger client pool, thus lowering unit costs overall. By choosing to allocate two major indirect costs—training and national care and treatment program support—by client rather than by site, the cost calculation effectively “penalized” sites with higher client loads. As the sensitivity analysis showed in Table 9, allocating these costs by site rather than by client lowers the unit costs of the high client-load sites and raises the unit costs of the low client-load sites.

The interpretation of observed differences in unit cost when grouping by other key characteristics is less straightforward. When looking at variation by ownership, it is not clear why government sites might be more expensive than mission sites or the single private, for-profit site. Furthermore, the study team cautions against inferring too much about such differences based on a small sample of sites and against using the result from the single private for-profit site as representative of all such private hospitals in Ghana. It is useful to remember that the team applied the same standard prices to all sites regardless of ownership, which may have masked some real differences in resource cost (for example of health workers and of physical infrastructure) that might vary by ownership type. Ownership could also reflect slightly

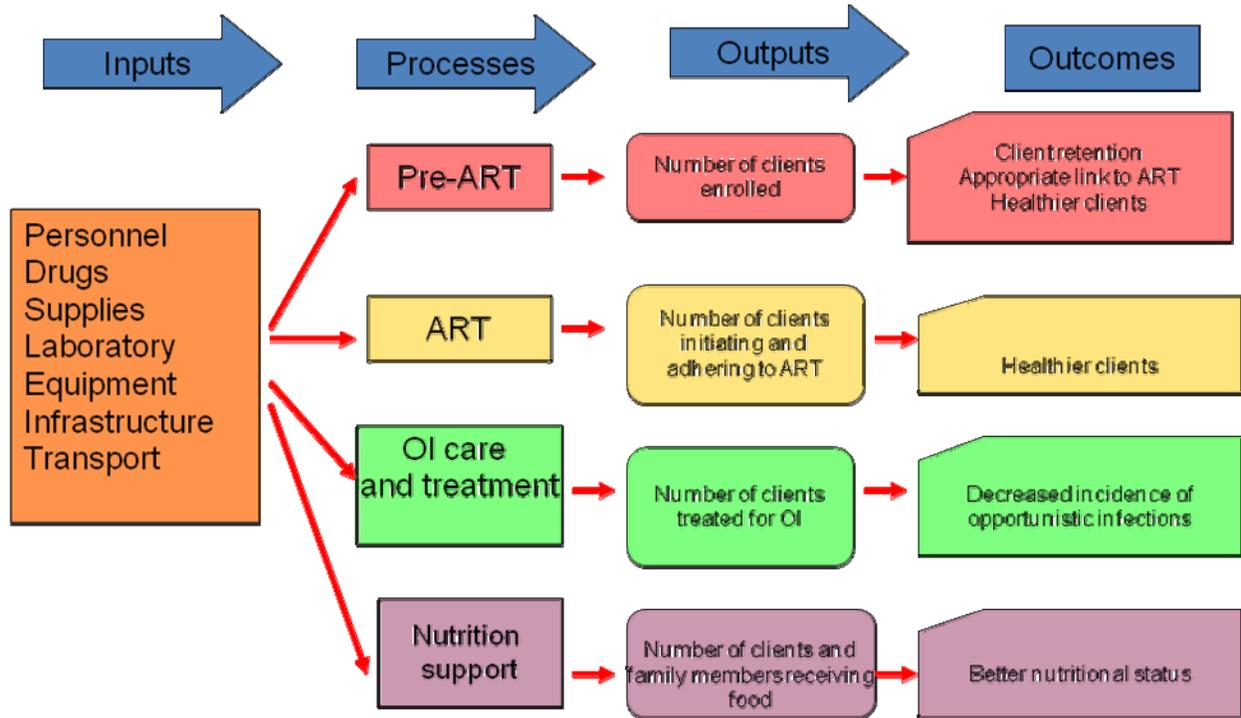
different treatment protocols, especially in terms of clinical monitoring and counseling visits. Further analysis may yield greater insight into differences by ownership. The team observed relatively little variation in unit cost by region, with unit costs about 13 percent lower on average in the 2 facilities located in high HIV prevalence areas compared with the 13 facilities located in medium prevalence areas of the country.

Understanding how unit costs might vary with program scale-up is important given the planned expansion of the national program, which—despite recent growth—currently covers only 28 percent of adults and 15 percent of children in need of antiretroviral therapy. Expansion of the client base at existing sites will most likely bring down unit costs, especially if most scale-up occurs at relatively high-cost, district-level facilities. In contrast, expansion through establishment of new clinical care sites will probably increase unit costs on average nationally because almost all new sites will be located at higher-cost district hospitals.

In conclusion, planners should find much of value in the study as they develop Ghana's national HIV & AIDS strategic plan and undertake other planning exercises. The results are already finding application in the Goals Model for five-year projections on the cost and impact of various combinations of HIV & AIDS interventions and for examining the cost implications of projected changes in first- and second-line drug regimens.

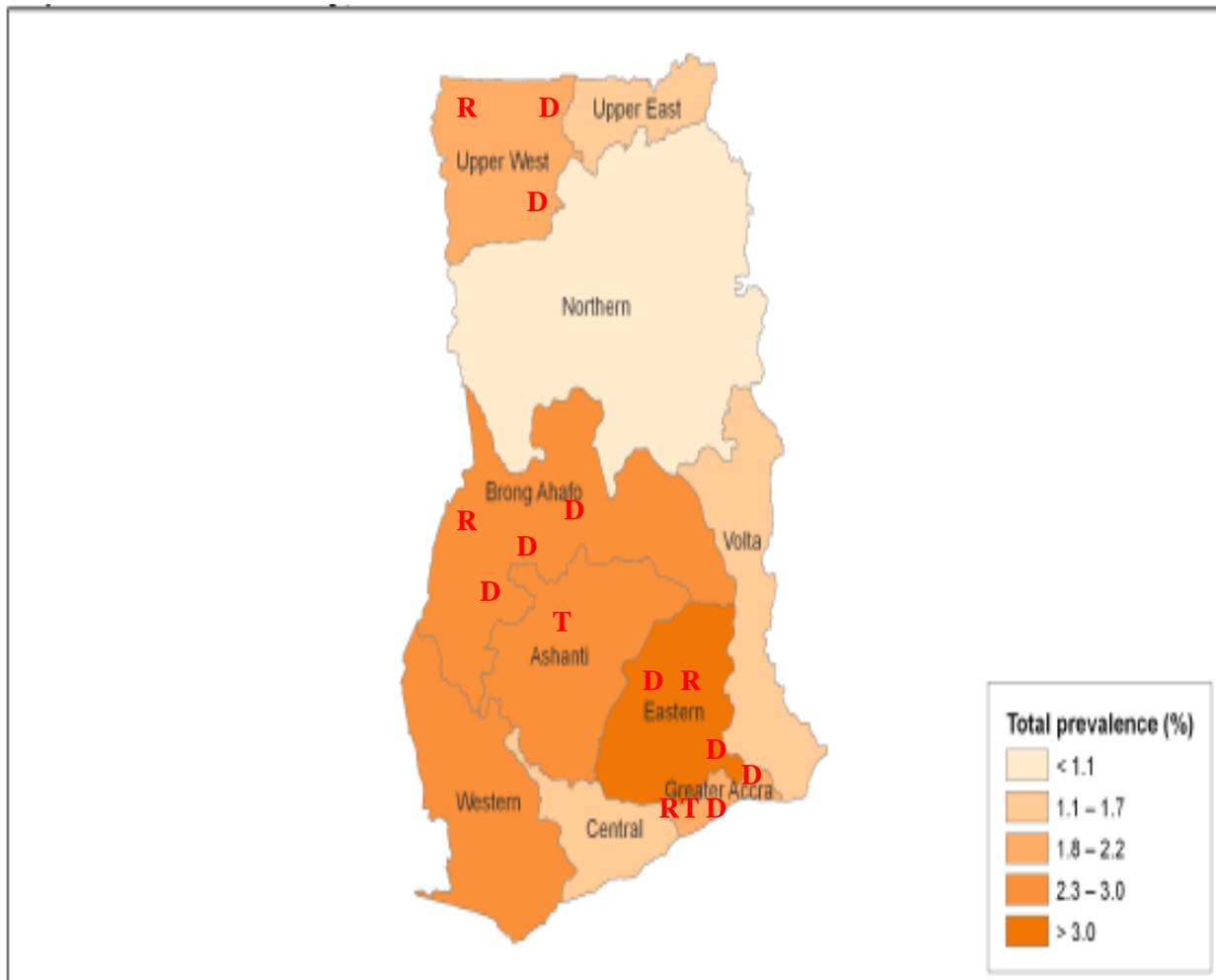
Closely involving Ghanaian officials and consultants in the study design, data collection, analysis, and reporting provides the opportunity for local stakeholders' further refinement and analysis of the data. Local stakeholders can use the results to look more closely at a range of topics, including how to use resources such as health workers, laboratory testing, and equipment more efficiently; the cost impact of different scale-up approaches; changes in ARV drug regimens and their effect on cost; and impact analysis through models such as Goals.

ANNEX I. SYSTEMS ANALYSIS OF THE GHANA ART PROGRAM



Source: Authors.

ANNEX 2. LOCATION OF STUDY SITES AND HIV PREVALENCE IN GHANA BY REGION



Key: T = Teaching hospital; R = Regional hospital; D = District hospital
 Source for map of prevalence data: WHO and UNAIDS (2008)

ANNEX 3. DETAILS ON COSTING METHODS AND ANALYSIS

For each main type of input, the table describes the methods and sources for estimating quantities of input, prices, and unit cost (cost per client per year). The inputs are grouped into categories of (1) direct costs per visit; (2) indirect costs directly associated with the ART program; and (3) general support costs.

I. Direct Costs per Visit		
Service Delivery Staff		
Quantities	Sources	Comments
Average number of minutes each health worker directly provides services to the typical client, by type of visit	Interviews with facility staff	Reported average times may not reflect real resources use. Reported average times does not incorporate down time and may underestimate true resource cost.
Prices	Sources	Comments
Calculated per minute of compensation for 20 categories of staff, based on 2009 Ghana Health Service (GHS) central-level data on compensation, adjusted for 2010 prices Additional compensation provided by national ART program Volunteer time valued at equivalent market rate per minute	GHS national data (Ghana Health Service 2009 salary structure) Interviews with facility staff For volunteers, interviews at each facility	Compensation includes salary and benefits.
Unit cost calculation		
For staff compensation: Average total number of minutes per worker multiplied by cost per minute, summed across type of worker		
OI Drugs		
Quantities	Sources	Comments
Actual: For each drug, quantity required for one patient for one year Normative: For each drug, quantity required for one patient for one year	Interviews with facility staff National norms for management of opportunistic infections (NACP, 2008a)	Includes 7% transport fee applied equally to all sites.
Prices	Sources	Comments
Price per drug dose	NHIS Medicines List (October 2009 prices available at http://www.nhis.gov.gh/?CategoryID=158&ArticleID=1096)	
Unit cost calculation		
Actual: Price per dose * doses per day * average number of treatment days *		

percent of clients receiving treatment. For each visit type, multiplied by the average number of visits per year, weighted by new and continuing clients. Normative: Price per dose * doses per day * average number of treatment days * percent of clients receiving treatment. Calculated separately for new and continuing clients and combined using weighted average of new and continuing clients. Calculated separately for adults and children.		
ARV Drugs		
Quantities	Sources	Comments
Quantity required for one patient for one year, by regimen and by first and second line, calculated for adults and children	NACP data on distribution of clients by drug regimen (NACP, 2010)	From port, any transport or storage fees is assumed to be included in general support costs of national ART program and GHS.
Prices	Sources	Comments
Negotiated international rate, prices to port	Central level information on negotiated ARV drug prices (NACP 2010 prices in US\$)	
Unit cost calculation		
Quantity for year multiplied by price for each regimen. We calculated a weighted cost for first- and second-line regimens using the distribution of clients by drug regimen. Calculated separately for adults and children.		
Medical Consumables and Other Supplies		
Quantities	Sources	Comments
Average quantity used per visit by type of visit	Facility staff interview	
Prices	Sources	Comments
Price of item used	Estimates by authors based on international and local prices	
Unit cost calculation		
Price per item multiplied by average quantity of items used in a visit. For each visit type, multiplied by the average number of visits per year weighted by new and continuing clients.		
Laboratory		
Quantities	Sources	Comments
Actual: For each test, quantity for one patient for one year	Interviews with facility staff	Does not include viral load testing, which is not currently

Normative: For each test, quantity for one patient for one year	National norms for management of ART clients (NACP, 2008b)	standard in the program.
Prices	Sources	Comments
Cost per laboratory test	For most tests, NACP facility reimbursement rates. Other sources include Korle-Bu teaching hospital testing price list and NHIS Diagnostic Centre Tariffs. All prices in 2010 cedis.	
Unit cost calculation		
Actual: For each test, price per test * average number of tests per client * percent of clients getting test. For each visit type, multiplied by average number of visits per year weighted by new and continuing clients. Normative: For each test, price per test * average number of tests per client * percent of clients getting test. Calculated separately for new and continuing clients and combined using a weighted average of new and continuing clients. Calculated separately for adults and children.		
Medical Equipment		
Quantities	Sources	Comments
Number and type of equipment used in each visit type	Walk-through of facility, interview with facility staff	
Prices	Sources	Comments
Replacement cost of item, straight-line depreciation by useful life	Estimates by authors based on international and local prices Useful life for each equipment type set by authors using international standards	
Unit cost calculation		
Yearly depreciated replacement cost * use in ART program as percentage of total use in facility ÷ yearly number of ART clients served by facility. We allocated cost to specific visit types based on whether equipment is used during visit and the proportion that each visit type represents as total of all visits using equipment.		
Vehicle Use in Direct Service Delivery		
Quantities	Sources	Comments
Number and type of vehicles used for service delivery	Walk-through of facility, interview with facility staff	

Prices	Sources	Comments
Replacement cost of item, straight-line depreciation by useful life	Price estimates by authors based on local prices Useful life set by authors using international standards	
Unit cost calculation		
Yearly depreciated replacement cost * use in ART program as percentage of total use in facility ÷ yearly number of ART clients served by facility. We allocated cost to specific visit types based on proportion that each visit type represents as total of all ART visits.		
Physical Infrastructure for Service Provision		
Quantities	Sources	Comments
Number of square meters of physical space used in ART program	Measured in each facility	
Prices	Sources	Comments
Cost per square meter based on rental cost of equivalent commercial space. Assumed cost of 10 cedis per month per square meter in Greater Accra and Eastern Region, 8 in Brong-Ahafo, and 5 in Upper West based on equivalent cost of renting commercial space.	Authors' estimates based on information from local property valuation experts	
Unit cost calculation		
Yearly cost per square meter * number of square meters * use of space in ART program as proportion of total use of space ÷ yearly number of ART clients served by facility		
Other Equipment Used in Direct Service Provision		
Quantities	Sources	Comments
Number and type of equipment used in each visit type	Walk-through of facility, interview with facility staff	
Prices	Sources	Comments
Replacement cost of item, straight-line depreciation by useful life	Estimates by authors based on international and local prices Useful life for each equipment type set by authors using international standards	
Unit cost calculation		
Yearly depreciated replacement cost * use in ART program as percentage of total use in facility ÷ yearly number of ART clients served by facility. We		

allocated cost to specific visit types based on whether equipment is used during visit and proportion that each visit type represents as total of all visits using equipment.		
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II. Indirect Costs Directly Associated with ART Program		
Administrative Staff Time Directly Associated with Program		
Quantities	Sources	Comments
Number of administrative staff and percentage of time spent on ART program in a year	Facility staff interview	
Prices	Sources	Comments
Calculated per minute of compensation based on 2009 GHS central level data on compensation, adjusted for 2010 prices	GHS central-level data (Ghana Health Service, n.d., 2009 Salary Structure)	Compensation includes all salary and benefits.
Unit cost calculation		
Yearly administrative personnel cost ÷ yearly number of ART clients served by facility		
Supervision of ART Program from Regional or Central Level		
Quantities	Sources	Comments
Fixed quantity of supervision per ART site	NACP Annual Report 2008	
Prices	Sources	Comments
Total amount allocated to regions for supervision, 2008 (GH¢ 690,484)	NACP Annual Report 2008	Inflated to 2010 prices.
Unit cost calculation		
Total yearly amount allocated to regions for supervision * proportion of supervision allocated to ART program (75%) ÷ total number of ART sites (127) ÷ yearly number of ART clients served by facility		
Office Equipment Used for Program Administration (furniture, computers, and so forth)		
Quantities	Sources	Comments
Number and type of equipment used for administration of ART program	Walk-through of facility, corroborated by facility inventory records	
Prices	Sources	Comments
Replacement cost of item, straight-line depreciation by useful life	Estimates by authors based on local prices	

	Useful life for each equipment type set by authors using international standards	
Unit cost calculation		
Yearly depreciated replacement cost * use in ART program as percentage of total use in facility ÷ yearly number of ART clients served by facility		
Vehicles Used for Administration		
Quantities	Sources	Comments
Number and type of vehicles used for service delivery	Walk-through of facility, interview with facility staff	
Prices	Sources	Comments
Replacement cost of item, straight-line depreciation by useful life	Price estimates by authors based on local prices Useful life set by authors using international standards	
Unit cost calculation		
Yearly depreciated replacement cost * use in ART program as percentage of total use in facility ÷ yearly number of ART clients served by facility. We allocated cost to specific visit types based on proportion that each visit type represents as total of all ART visits.		
Administrative Physical Infrastructure		
Quantities	Sources	Comments
Number of square meters of physical space used in ART program	Measured in each facility	
Prices	Sources	Comments
Cost per square meter based on rental cost of equivalent commercial space. Assumed cost of 10 cedis per month per square meter in Greater Accra and Eastern Region, 8 in Brong-Ahafo, and 5 in Upper West based on equivalent cost of renting commercial space.	Authors' estimates based on information from local property valuation experts	
Unit cost calculation		
Yearly cost per square meter * number of square meters * use of space in ART program as proportion of total use of space ÷ yearly number of ART clients served by facility		
Other Administrative Costs (office supplies, legal costs, audit, and so forth)		
Quantities	Sources	Comments
Varies by facility	Interview of facility staff, review of facility records	

Prices	Sources	Comments
Total cost for year	Local facility	
Unit cost calculation		
Total yearly cost ÷ yearly number of ART clients served by facility		
Transportation		
Quantities	Sources	Comments
Prices	Sources	Comments
Annual transport costs for facility	Interview of facility staff, review of facility records	
Unit cost calculation		
Total yearly cost * ART visits as proportion of all outpatient visits at facility * outpatient visits as proportion of all facility services ÷ yearly number of ART clients served by facility		Outpatient visits assumed to consume 75% of resources at facilities.
Public Utilities (water, electricity, telephone, Internet) Used for Program		
Quantities	Sources	Comments
Prices	Sources	Comments
Annual costs for facility as a whole	Interview of facility staff, review of facility records	
Unit cost calculation		
Total yearly cost * ART visits as proportion of all outpatient visits at facility * outpatient visits as proportion of all facility services ÷ yearly number of ART clients served by facility		Outpatient visits assumed to consume 75% of resources at facilities.
Maintenance and Repair		
Quantities	Sources	Comments
Prices	Sources	Comments
Annual costs for facility as a whole	Interview of facility staff, review of facility records	
Unit cost calculation		
Total yearly cost * ART visits as proportion of all outpatient visits at facility * outpatient visits as proportion of all facility services ÷ yearly number of ART clients served by facility		Outpatient visits assumed to consume 75 % of resources at facilities.
Staff Training Directly Associated with Providing ART Services		
Quantities	Sources	Comments
Prices	Sources	Comments
Total spent on training at central, regional, and district levels	NACP Annual Report 2008 NACP 2009 Spending	

Unit cost calculation		
Total spent on training * proportion of training costs allocated to ART program ÷ total number of ART clients nationally	Authors' estimates of percentage of training allocated to ART program	

III. General Support Costs		
ART Program National Administrative Support		
Quantities	Sources	Comments
Prices	Sources	Comments
Total annual NACP support cost	NACP Spending 2009	
Unit cost calculation		
Total annual NACP support cost * proportion of support costs allocated to ART program (75%) ÷ total number of ART clients nationally	Authors' estimates of percent of proportion of support costs allocated to ART program	
Ghana Health Service National Administrative Support		
Quantities	Sources	Comments
Prices	Sources	Comments
Total national GHS support costs less NACP support costs	MOH 2009 Programme of Work NACP Spending 2009	
Unit cost calculation		
(Total national GHS support costs less NACP support costs) * percent of total associated with outpatient care (75%) ÷ total number of outpatient visits nationally * average number of visits per ART client	Authors' estimate of percent of total associated with outpatient care	GH¢ 5.36 per outpatient visit.

ANNEX 4. TABLES WITH DETAILED COST RESULTS

Annex Table I. Cost per Client per Year, HIV Clinical Care Program, by Direct and Indirect Costs (Cedis)

	National Average			Level			Ownership		Geographic Region			HIV Prevalence	
	Not Weighted	Weighted	Teaching	Regional	District	Government	Mission	For-Profit	Coastal	Forest	Savannah	High	Medium
Total (cedis)	929	758	794	831	1,002	921	883	738	941	867	1,052	819	946
I. Direct Costs	558	477	494	515	590	549	552	460	580	542	557	534	561
Service delivery staff	71	42	53	74	74	73	81	22	52	86	68	112	65
OI drugs	35	35	35	35	35	35	35	35	35	35	35	35	35
ARV drugs	202	202	202	202	202	202	202	202	202	202	202	202	202
Medical consumables	3	1	2	1	4	2	5	0	1	3	4	2	3
Laboratory	174	174	174	174	174	174	174	174	174	174	174	174	174
Medical equipment	24	4	0	6	37	22	13	1	31	8	49	3	27
Vehicles	1	0	0	1	1	1	1	0	0	1	1	1	1
Other equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical infrastructure	47	18	27	22	63	40	41	25	84	31	24	3	54
II. Indirect Costs	371	280	300	316	412	372	331	278	362	325	495	285	384
a. Facility Indirect Costs	201	128	136	150	238	204	152	133	203	149	320	127	212
Administrative personnel	34	9	3	17	48	34	23	11	32	18	74	12	37
Supervision	16	3	3	4	24	13	11	12	20	8	27	2	18
Office equipment	3	1	1	1	5	2	2	3	4	2	5	1	4
Administrative vehicles	4	0	1	1	7	1	3	0	9	2	2	0	5
Administrative physical infrastructure	9	3	20	1	10	6	0	0	18	6	1	1	10
Other administrative	2	0	0	0	3	3	0	0	6	0	0	0	2
Transportation costs	4	2	0	3	4	5	2	0	2	2	10	2	4
Public utilities	2	1	0	0	4	3	1	2	3	1	4	2	2
Maintenance and repair	22	6	4	19	27	30	7	3	3	7	87	2	25
Training	105	103	103	104	106	106	103	103	105	104	109	105	105

b. General Support Costs	170	152	164	166	173	168	178	145	159	176	175	158	172
NACP national administrative support	127	127	127	127	127	127	127	127	127	127	127	127	127
GHS national administrative support	43	25	37	39	46	41	51	18	32	49	48	31	45
Total (US\$)	\$655	\$534	\$560	\$586	\$706	\$649	\$622	\$520	\$664	\$611	\$742	\$577	\$667

Source: Authors.

Annex Table 2. Cost per Client per Year, HIV Clinical Care Program, by Direct and Indirect Costs (Percent of Total Cost)

	National Average			Level			Ownership		Geographic Region			HIV Prevalence	
	Not Weighted	Weighted	Teaching	Regional	District	Government	Mission	For-Profit	Coastal	Forest	Savannah	High	Medium
Total (Percentage)	100	100	100	100	100	100	100	100	100	100	100	100	100
I. Direct Costs	60%	63%	62%	62%	59%	60%	63%	62%	62%	63%	53%	65%	59%
Service delivery staff	8%	6%	7%	9%	7%	8%	9%	3%	5%	10%	6%	14%	7%
OI drugs	4%	5%	4%	4%	3%	4%	4%	5%	4%	4%	3%	4%	4%
ARV drugs	22%	27%	25%	24%	20%	22%	23%	27%	22%	23%	19%	25%	21%
Medical consumables	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%
Laboratory	19%	23%	22%	21%	17%	19%	20%	24%	19%	20%	17%	21%	18%
Medical equipment	3%	1%	0%	1%	4%	2%	1%	0%	3%	1%	5%	0%	3%
Vehicles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Physical infrastructure	5%	2%	3%	3%	6%	4%	5%	3%	9%	4%	2%	0%	6%
II. Indirect Costs	40%	37%	38%	38%	41%	40%	37%	38%	38%	37%	47%	35%	41%
a. Facility Indirect Costs	22%	17%	17%	18%	24%	22%	17%	18%	22%	17%	30%	15%	22%
Administrative personnel	4%	1%	0%	2%	5%	4%	3%	2%	3%	2%	7%	1%	4%
Supervision	2%	0%	0%	0%	2%	1%	1%	2%	2%	1%	3%	0%	2%
Office equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Administrative vehicles	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%	0%	1%
Administrative physical infrastructure	1%	0%	3%	0%	1%	1%	0%	0%	2%	1%	0%	0%	1%
Other administrative	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Transportation costs	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%
Public utilities	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maintenance and repair	2%	1%	0%	2%	3%	3%	1%	0%	0%	1%	8%	0%	3%
Training	11%	14%	13%	12%	11%	12%	12%	14%	11%	12%	10%	13%	11%
II.B General Support Costs	18%	20%	21%	20%	17%	18%	20%	20%	17%	20%	17%	19%	18%
NACP national administrative support	14%	17%	16%	15%	13%	14%	14%	17%	13%	15%	12%	16%	13%
GHS national administrative support	5%	3%	5%	5%	5%	4%	6%	2%	3%	6%	5%	4%	5%

Source: Authors.

**Annex Table 3. Distribution of Fixed and Variable Costs of HIV Clinical Care Program
(Percent of Total Cost)**

	National Average			Level			Ownership		Geographic Region		
	Unweighted	Weighted	Teaching	Regional	District	Government	Mission	For-Profit	Coastal	Forest	Savannah
Total (Percentage)	100	100	100	100	100	100	100	100	100	100	100
I. Fixed Costs	55%	45%	48%	50%	58%	55%	53%	44%	56%	52%	59%
Service delivery staff	8%	6%	7%	9%	7%	8%	9%	3%	5%	10%	6%
Administrative personnel	4%	1%	0%	2%	5%	4%	3%	2%	3%	2%	7%
Supervision	2%	0%	0%	0%	2%	1%	1%	2%	2%	1%	3%
Office equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Administrative vehicles	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Administrative physical infrastructure	1%	0%	3%	0%	1%	1%	0%	0%	2%	1%	0%
Other administrative	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Medical equipment	3%	1%	0%	1%	4%	2%	1%	0%	3%	1%	5%
Vehicles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Physical infrastructure	5%	2%	3%	3%	6%	4%	5%	3%	9%	4%	2%
Public utilities	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maintenance and repair	2%	1%	0%	2%	3%	3%	1%	0%	0%	1%	8%
Training	11%	14%	13%	12%	11%	12%	12%	14%	11%	12%	10%
NACP national administrative support	14%	17%	16%	15%	13%	14%	14%	17%	13%	15%	12%
GHS national administrative support	5%	3%	5%	5%	5%	4%	6%	2%	3%	6%	5%
II. Variable Costs	45%	55%	52%	50%	42%	45%	47%	56%	44%	48%	41%
OI drugs	4%	5%	4%	4%	3%	4%	4%	5%	4%	4%	3%
ARV drugs	22%	27%	25%	24%	20%	22%	23%	27%	22%	23%	19%
Medical consumables	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Laboratory	19%	23%	22%	21%	17%	19%	20%	24%	19%	20%	17%
Transportation costs	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%

Source: Authors.

Annex Table 4. Distribution of Current and Capital Costs of HIV Clinical Care Program (Percent of Total Cost)

	National Average			Level			Ownership		Geographic Region		
	Unweighted	Weighted	Teaching	Regional	District	Government	Mission	For-Profit	Coastal	Forest	Savannah
Total (Percentage)	100	100	100	100	100	100	100	100	100	100	100
Current	79%	83%	81%	84%	77%	81%	82%	82%	73%	82%	82%
Service delivery staff	8%	6%	7%	9%	7%	8%	9%	3%	5%	10%	6%
Drugs	4%	5%	4%	4%	3%	4%	4%	5%	4%	4%	3%
ARV drugs	22%	27%	25%	24%	20%	22%	23%	27%	22%	23%	19%
Medical consumables	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Laboratory	19%	23%	22%	21%	17%	19%	20%	24%	19%	20%	17%
Administrative personnel	4%	1%	0%	2%	5%	4%	3%	2%	3%	2%	7%
Supervision	2%	0%	0%	0%	2%	1%	1%	2%	2%	1%	3%
Other administrative	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Transportation costs	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%
Public utilities	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maintenance and repair	2%	1%	0%	2%	3%	3%	1%	0%	0%	1%	8%
NACP national administrative support	14%	17%	16%	15%	13%	14%	14%	17%	13%	15%	12%
GHS national administrative support	5%	3%	5%	5%	5%	4%	6%	2%	3%	6%	5%
Capital	21%	17%	19%	16%	23%	19%	18%	18%	27%	18%	18%
Medical equipment	3%	1%	0%	1%	4%	2%	1%	0%	3%	1%	5%
Vehicles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Administrative vehicles	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Administrative physical infrastructure	1%	0%	3%	0%	1%	1%	0%	0%	2%	1%	0%
Training	11%	14%	13%	12%	11%	12%	12%	14%	11%	12%	10%
Physical infrastructure	5%	2%	3%	3%	6%	4%	5%	3%	9%	4%	2%
Office equipment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%

Source: Authors.

**Annex Table 5. Distribution of Costs of HIV Clinical Care Program, by Input Type
(Percent of Total Cost)**

	National Average			Level			Ownership		Geographic Region			HIV Prevalence	
	Unweighted	Weighted	Teaching	Regional	District	Government	Mission	For-Profit	Coastal	Forest	Savannah	High	Medium
Total (Percentage)	100	100	100	100	100	100	100	100	100	100	100	100	100
Personnel	13%	7%	8%	11%	15%	13%	13%	6%	11%	13%	16%	15%	13%
Transport	1%	0%	0%	1%	1%	1%	1%	0%	1%	1%	1%	0%	1%
Equipment	5%	1%	1%	3%	7%	6%	2%	1%	4%	2%	13%	1%	6%
Supplies	45%	55%	52%	50%	42%	46%	47%	56%	45%	48%	40%	51%	44%
Infrastructure	6%	3%	6%	3%	7%	5%	5%	3%	11%	4%	2%	1%	7%
Other (program support costs, training)	30%	34%	34%	32%	28%	30%	32%	34%	28%	32%	27%	32%	29%

Source: Authors.

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