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# ASSESSMENT OF THE GHANA LABORATORY LOGISTICS SYSTEM AND SERVICES



Republic of Ghana



MARCH 2006

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MARCH 2006

## **DELIVER**

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Implemented by John Snow, Inc. (JSI), (contract no. HRN-C-00-00-00010-00) and subcontractors (Manoff Group, Program for Appropriate Technology in Health [PATH], and Crown Agents Consultancy, Inc.), DELIVER strengthens the supply chains of health and family planning programs in developing countries to ensure the availability of critical health products for customers. DELIVER also provides technical management of USAID's central contraceptive management information system.

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## **Abstract**

The Ghana antiretroviral therapy (ART) program is implementing a comprehensive strategy to curb the HIV epidemic in Ghana. Part of the strategy is to substantially expand the ART program by the end of 2006. In support of that expansion, voluntary counseling and testing (VCT) and prevention of mother-to-child transmission (PMTCT) will be scaled up. The program currently has 163 laboratory sites that provide clinical testing, VCT, PMTCT, and sentinel surveillance, as well as testing for other health components.

This assessment of laboratory services and logistics system follows an initial technical assistance visit by the DELIVER project, which was conducted in June–July 2005 to map the Ghanaian laboratory quality assurance referral system. The current assessment of the laboratory system conducted by the DELIVER project (headquarters and Ghana field office) and the Ghana national counterparts in March 2006 is a first step toward the design of a laboratory logistics management information system.

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# ACRONYMS

AIDS	acquired immune deficiency syndrome
ART	antiretroviral therapy
ARV	antiretroviral
ASAP	as soon as possible
ATLAS	Assessment Tool for Laboratory Services
BMC	budget management center
CMS	central medical stores
CT	counseling and testing
CD4	T4 or helper lymphocytes, the quantitative count of these cells
DFID	Department for International Development (U.K.)
DHMT	District Health Management Team
DH	district hospital
EM	essential medicine
EPI	Expanded Programme on Immunization
EQA	external quality assurance
FEFO	first-to-expire, first-out
FHI	Family Health International
GHS	Ghana Health Services
GOG	Government of Ghana
GRMA	Ghana Registered Midwives Association
HACS	HIV/AIDS commodity security
HC	health center
HIV	human immunodeficiency virus
HLS	Health Laboratory Services
IT	information technology
JICA	Japanese International Cooperation Agency
JSI	John Snow, Inc.
LMIS	logistics management information system
MAP	Multicountry AIDS Program (World Bank)
MCH	Maternal and Child Health
MIS	management information system
MOH	Ministry of Health
MOU	memorandum of understanding
NACP	National AIDS Control Program
OJT	on-the-job training
PEP	post-exposure prophylaxis

PHRL	Public Health Reference Laboratory
PMTCT	prevention of mother-to-child transmission
PRP	Preparedness and Response Plan
QA	quality assurance
QC	quality control
RMS	Regional Medical Stores
SOP	standard operating procedure
SSDM	Stores Supplies and Drug Management
TA	technical assistance
TAP	Treatment Acceleration Program (World Bank)
TB	tuberculosis
USAID	United States Agency for International Development
VCT	voluntary counseling and testing
WHO	World Health Organization

# ACKNOWLEDGMENTS

The authors acknowledge the support given for this assessment by the Ghana Ministry of Health and Ghana Health Services, the National AIDS Control Program, and the Public Health Reference Laboratory. The authors are grateful to hospitals and health center staff, donors, nongovernmental organizations, and cooperating agency staff (listed in the appendices) who participated directly in this laboratory logistics system and services assessment. The success of the Ghana national HIV/AIDS program will depend on the continued collaboration, goodwill, and hard work of all partners if we are to meet the many challenges of ensuring a continuous supply of quality health laboratory reagents, consumables, and durables to the people who need them, where and when they need them, and to relieve suffering.



# EXECUTIVE SUMMARY

Laboratory services are an essential component of the antiretroviral therapy (ART) program that is implemented by the Ministry of Health of Ghana. The Government of Ghana has recognized that laboratory capacity is a vital part of a comprehensive strategy to curb the HIV/AIDS epidemic; it is committed to taking necessary action to strengthen all aspects of laboratory services. Laboratories will support the ART scale-up plan, including expansion of programs for clinical testing, voluntary counseling and testing, and prevention of mother-to-child transmission.

An initial technical assistance visit was conducted by the DELIVER project in June–July 2005 to map the Ghanaian laboratory quality assurance referral system. One recommendation from this visit was to conduct an assessment of the Ghana laboratory system to identify areas that require strengthening.

This assessment of the laboratory system is the initial step toward improving laboratory services and the design of a laboratory logistics information system. The objective of the assessment was to evaluate laboratory capacity and develop a plan for systematically improving the laboratory system. The assessment goal was to provide overall system recommendations but not facility-specific interventions.

Assessment teams, which included Ghana Health Services and DELIVER staff, surveyed 30 laboratories at various levels in seven of the 10 regions of Ghana. The assessment results provide—

- a snapshot of the laboratory supply logistics systems
- a sampling of the capacity of public-sector laboratories within the context of good laboratory practice
- a review of the national laboratory policies, financing, forecasting and quantification of supplies, human resources, and information management systems that are part of the current laboratory structure
- proposed recommendations for areas to improve in the current laboratory system.

Some of the strengths of the Ghana laboratory logistics system and services include the development of national laboratory policies and some technical standard operating procedures, adequate storage capacity, and stable laboratory infrastructure. However, efforts need to be made in disseminating and applying the policies and procedures; designing and implementing appropriate inventory control and logistics management information systems; and developing guidelines for safe disposal and destruction of sharps, and for post-exposure prophylaxis.

This report makes recommendations and proposes an implementation plan for strengthening national policy, finance structure, forecasting and procurement methodologies, human resource development, testing services, and quality assurance/quality control. It also provides specific recommendations for the design of a laboratory logistics system that encompasses all aspects of

supply chain management. This should be a collaborative effort with significant input from the field and substantial involvement of all stakeholders. It will require significant resource mobilization from the Government of Ghana, multiple donors, and the community; and the coordination of donors, service providers, and system managers.

# BACKGROUND

The Ministry of Health (MOH) of Ghana, with support from the U.S. States Agency for International Development (USAID) and other donors, has developed a comprehensive strategy to curb the HIV/AIDS epidemic in Ghana. DELIVER has been asked to assist in the implementation of this strategy in the following areas:

- assessing the Ghana logistics system capacity and readiness to manage antiretroviral drugs and other essential antiretroviral therapy (ART) program commodities (this was completed in 2003)
- building capacity in antiretroviral (ARV) and HIV test kit forecasting and quantification
- developing an HIV/AIDS commodity security plan, including quality assurance strengthening
- strengthening the laboratory supply logistics system to support ART and HIV/AIDS prevention services.

In December 2004, an estimated 4,000 patients were on ART. The Government of Ghana's (GOG) target is to have 15,000 patients on ART by December 2006. To support that, the GOG is scaling up HIV testing and ART sites.

The Ghana ART program currently has five sites. There are also four private for-profit facilities offering ART; they are supported by the World Bank's Treatment Acceleration Program (TAP). Expansion plans for 2006 include all ten regional hospitals in the country by the end of 2006, six mission facilities funded by TAP, and one or two additional private for-profit facilities supported by TAP between June and December 2006.

HIV testing can be disaggregated into the following types: clinical testing (CT), voluntary counseling and testing (VCT), prevention of mother-to-child transmission (PMTCT), and sentinel surveillance. At this time, 163 sites offer one or more of these services; the majority of these sites are in the Eastern and Ashanti regions. The goal is for the VCT program to have 210,000 clients accessing these services by the end of 2006. Currently, the program is offering VCT services to approximately 35,000 clients, including diagnostic testing. The PMTCT target is for 60,000 pregnant women to be tested; an estimated 1,200 women will require PMTCT ARVs.

An essential ingredient of the Ghana ART program scale-up plan is the CD4 count testing, certain chemistry tests, and hematology testing. The CD4 count test is used to indicate when a patient should start ART (patients of CD4 cell count less than 250 should be put on therapy), and this test is used to monitor patients receiving ART. The chemistry and hematology tests help monitor a patient's response to treatment.

Ghana currently has 25 CD4 machines, which are located in nine of the 10 regional laboratories, two teaching hospitals, and a few district hospitals. The machines are relatively new and are expected to be adequate for the testing requirements for the near future.

Nine of the 10 regional hospitals<sup>1</sup> also have automated chemistry and hematology machines. The MOH plans to buy semiautomatic chemistry and hematology analyzers for district-level facilities.

Currently, the private-sector sites providing ART do not all have CD4 machines. They are negotiating a memorandum of understanding (MOU) with the MOH that authorizes them to supply ARVs with limited mark-up. These facilities will then be linked to neighboring ART centers with CD4 machines and they will be allowed to send samples for testing at no additional cost. The MOU strictly states that these facilities are required to charge the patient no more than the public-sector cost for ARVs. To ensure quality, these private-sector sites will be accredited by the National AIDS Control Program.

DELIVER began working in laboratory strengthening in June–July 2005 when a consultant conducted an initial technical visit to map the Ghanaian laboratory quality assurance referral system as a possible best-practices model for laboratories in limited-resource settings. This best-practice model will be a key element in the proposed laboratory standardization process for laboratory capacity building in support of HIV/AIDS care programs. One of the follow-up actions suggested by the consultant was that an assessment be made of the laboratory logistics system in Ghana to ensure continuous supply of critical reagents.

The current technical visit was conducted by three consultants from the DELIVER project headquarters, one consultant from the DELIVER field office staff in Ghana, and two Ghanaian national counterparts. The six team members assessed the laboratory system as a first step toward strengthening the laboratory services and logistics system.

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<sup>1</sup> Kumasi South Regional Hospital does not have automated equipment, but the public health laboratory that is located within the same facility provides these services.

# OBJECTIVES OF THE ASSESSMENT

The overall purpose of the DELIVER technical assistance (TA) was to work closely with the Ghana MOH and the Ghana Health Services (GHS), the National AIDS Control Program (NACP), and the DELIVER field office staff in Ghana to facilitate a representative assessment of the laboratory system related to CT, VCT, PMTCT, sentinel sites, and ART sites. The goal of the assessment was to provide overall system recommendations but not facility-specific interventions.<sup>2</sup>

The objectives of the assessment were to—

- assess the logistics system and services of the laboratory system from a representative sample of government-supported laboratories
- provide a snapshot of the current laboratory supply chain
- develop a system improvement plan derived from the data analysis.

The deliverables from this assessment will be used to create a detailed action plan, including the mobilization of resources, for improving laboratory logistics and services.

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<sup>2</sup> A facility-specific assessment would require the assessment team to visit every laboratory in the system and provide detailed interventions for each laboratory as well as overall systemic recommendations.



# METHODOLOGY

A team of representatives from the Ghana MOH/GHS laboratory services and DELIVER staff used an adaptation of the Assessment Tool for Laboratory Services (ATLAS) to conduct the assessment.

## **STEPS AND ASSESSMENT ACTIVITIES**

The overall duration of the assessment was three weeks and included preparation, meetings, site visits, and presentation of the findings. The following steps were taken to prepare and conduct the laboratory logistics system and services assessment.

During the first week, the assessment team focused on interviewing key stakeholders and adapting the ATLAS for the Ghana laboratory system context. This included interviewing staff from the MOH and GHS, the Public Health Reference Laboratory (PHRL), the NACP, and the Procurement and Supplies Division of the MOH. The ATLAS was customized for the Ghana laboratory logistics system settings, standards, and language on the basis of feedback received from the stakeholders. The assessment team members were trained in the use of the ATLAS, and the tool was field tested at four sites within the Greater Accra region. The final version was completed with input from the field tests and presented to the stakeholders. The final version of the central-level questionnaire was used to interview key informants at the central administrative level.

Field visits to conduct the assessment took place during the second week at selected facilities (see section on Sampling Methodology for more information about site selection). Application of the ATLAS at each facility included interviewing key personnel and conducting physical inventory of commodities.

The final week of the assessment focused on synthesis of the assessment results and findings, presentation of the results to the stakeholders, and preparation of the draft report by the team.

## **ASSESSMENT TEAM**

The assessment team comprised the following members from the GHS, PHRL, and DELIVER:

- Festus Sroda, Laboratory Technologist, GHS/Kumasi Region
- Rowland Adukpo, Laboratory Scientist, GHS/PHRL, Korle Bu Teaching Hospital
- Parfait Edah, Resident Advisor, DELIVER Ghana
- Egbert K. Bruce, Program Officer, DELIVER Ghana
- Ronald Brown, Laboratory Logistics Advisor, DELIVER DC
- Wendy Nicodemus, Public Health Logistics Advisor, DELIVER DC
- Aoua Diarra, Coordinator for Country Programs, DELIVER DC.

The team was divided into three assessment groups, which were tasked with visiting eight laboratory facilities in six different regions. Appendix 1 displays the trip itinerary; appendix 2 provides the schedule for the field visits.

### **ASSESSMENT TOOL**

The tool used for this survey was the ATLAS, a data-gathering instrument developed by DELIVER to assess laboratory services and logistics. The ATLAS is a diagnostic and monitoring tool that can be used for a baseline survey, an annual assessment, or as an integral part of the work planning process. It is primarily qualitative, with a small sample facility quantitative survey of available commodities, testing services, and equipment. The information collected with the ATLAS is analyzed to identify issues and opportunities and to outline further assessment and/or appropriate interventions. The ATLAS has three questionnaires:

- a central-level questionnaire that is used to collect information on national policies and guidelines, and organizational aspects of the system
- a regional-level administrative questionnaire that gathers information on regional policies, guidelines, and facilities numbers and types
- a facility-level questionnaire that is applied in laboratories at central, regional, and district levels, and in health centers.

### **SAMPLING METHODOLOGY**

According to information received from the PHRL at Korle Bu Teaching Hospital, Ghana currently has 163 laboratory facilities at all levels participating in HIV testing (CT and VCT), ART support, PMTCT, or sentinel surveillance (see appendix 3 for complete list). A minimum of a 10 percent sample size (16 or more laboratories) was suggested during the preparatory phase in Washington, DC. This objective could be achieved within one week with three teams, each visiting two regions and visiting four facilities per region. The four facilities at each region were intended to include a regional hospital laboratory, two district laboratories, and one health center laboratory. The situation on the ground, however, was different: some laboratories thought to be at the district level were found to be health centers, and some health centers that were believed to have functioning laboratories did not have them. Therefore, the regional sample did not always follow the proposed composition.

The initial selection activity was the random choice of three out of the 10 regions: Northern, Ashanti, and Eastern. It was then agreed by the team members that, to make the best use of the limited time available for the site visits, the most convenient choice would be the regions adjacent to the first three selected. As a result, the Central, Volta, and Upper East regions were selected and added to the sample. Four facilities were then selected in each of those six regions, including at least one facility at all levels of the system. The sample size increased during the field visits: one team visited an additional public health laboratory in the Northern region responsible for HIV and CD4 testing. To ensure that all levels were represented in the sample, the teams visited the national reference laboratory at the central level after returning from the field visits. The sample size from the field visits was 26 facilities, which was considered to be an appropriate representation of the population of public laboratories in Ghana. The total assessment sample represented 30 facilities, including the four field test sites. Table 1 shows the types of sites visited in Ghana.

**Table 1. Facilities Visited during the Ghana Laboratory Logistics System and Services Assessment**

Type of Facilities	Number Visited	Comments
Central Level Facility (Reference Lab)	1	PHRL
Regional Lab	7	
Public Health Lab	1	Tamale
District Lab	14	
Subdistrict/Health Center Lab	7	
<b>Total</b>	<b>30</b>	

### **LIMITATIONS OF ASSESSMENT**

The following limitations may affect the generalizations of the assessment:

- To successfully assess the projected 24 sites during one week, the three teams had to conduct a convenient sampling consisting of pairing sites for ease of transportation.
- One health center did not have a functioning laboratory and had to be replaced in the sample with a district hospital; in other words, one region did not have representation from the health center level.
- Some sites selected as health centers had been recently upgraded to district hospitals without being technically brought to the district standard. The assessment team considered them as subdistrict facilities to avoid skewing the assessment results.
- This assessment was not a facility-based assessment; it can only provide system wide recommendations rather than specific facility improvements.

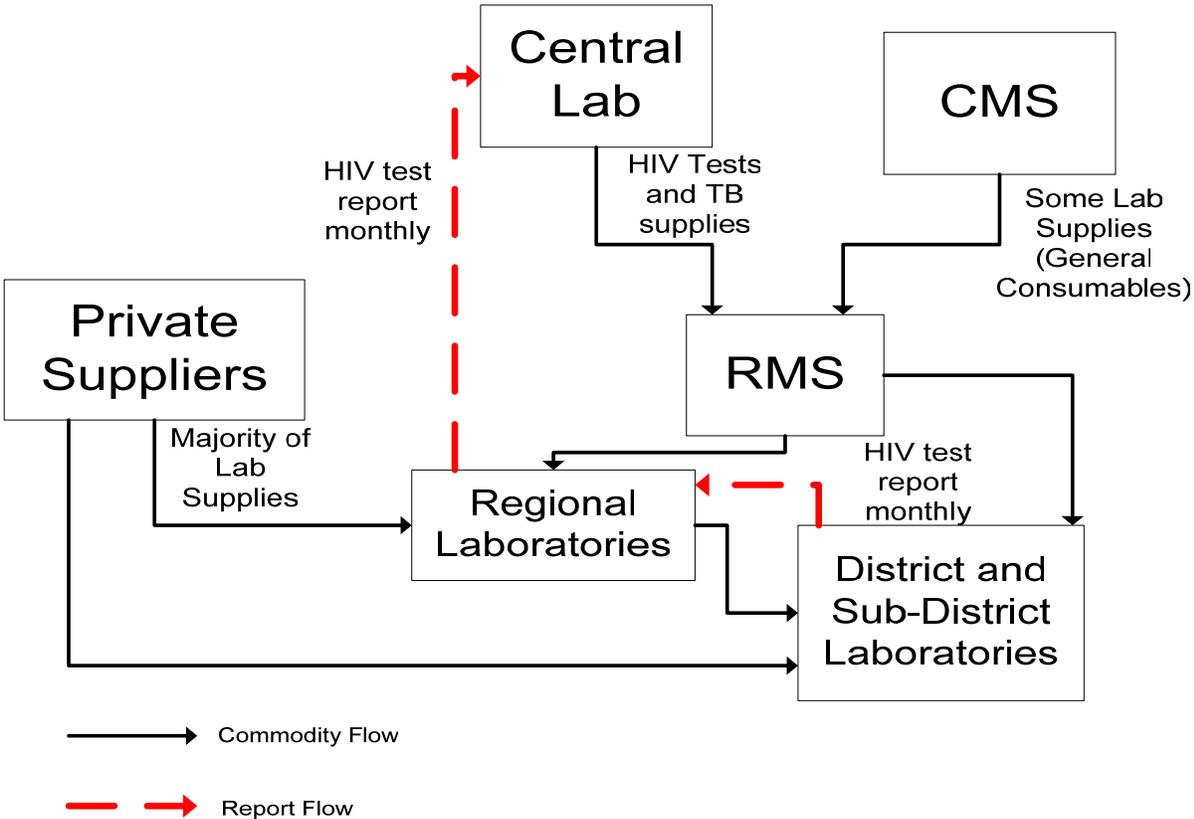


# FINDINGS

## SNAPSHOT OF THE CURRENT SUPPLY CHAIN

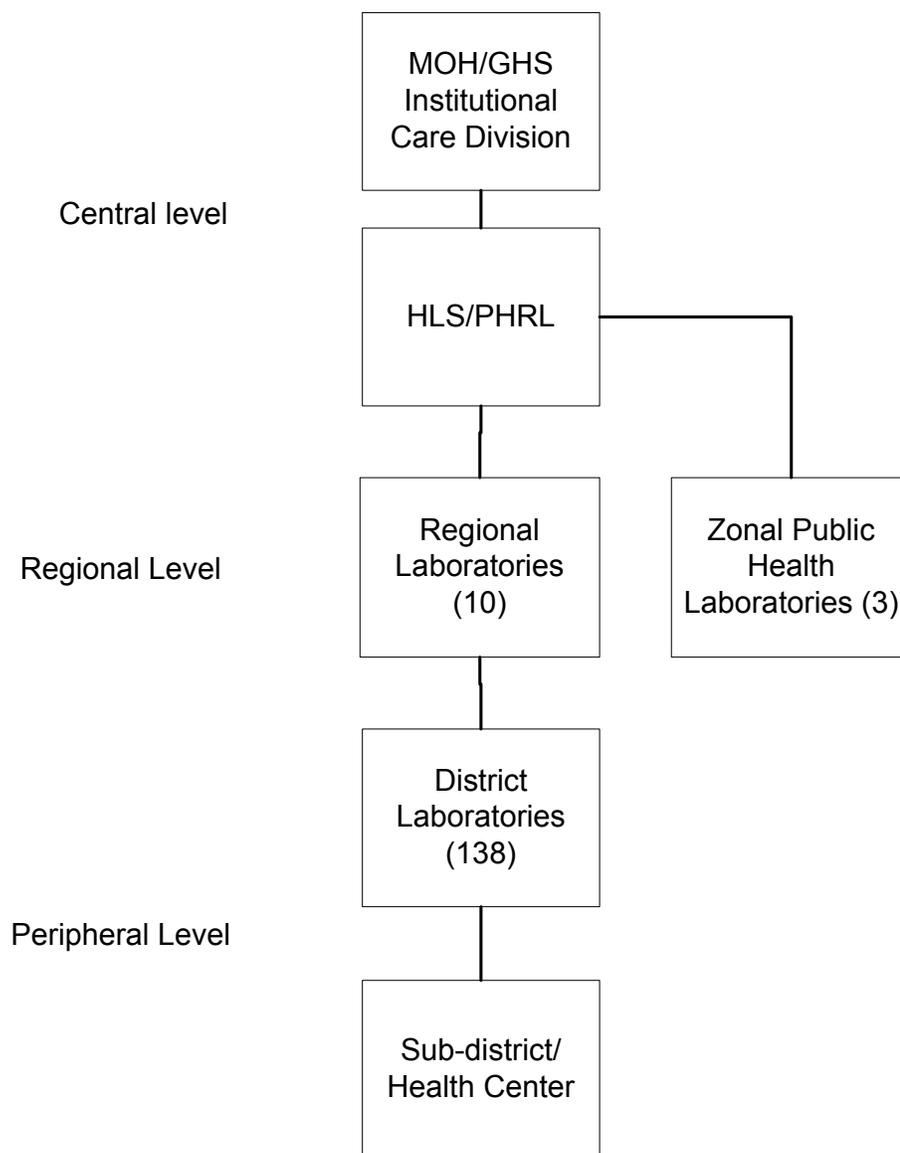
Figure 1 depicts the flow of reports and laboratory product within the Ghana laboratory system. The solid lines show the flow of products, and the dotted lines show the flow of reports. HIV tests and tuberculosis (TB) testing supplies are distributed from the central laboratory (the PHRL). Typically, the regional laboratory coordinator retrieves the supplies from the PHRL. Some other laboratory supplies, particularly general consumables such as bleach, gloves, and the like, are provided at a cost to the user from the central medical stores (CMS). Laboratory supplies that are not available from the CMS (the majority of supplies) are procured by each laboratory from private suppliers, who generally bring the supplies to the laboratory. Currently, the only laboratory supply logistics reports that move through the system are for HIV tests. These reports move monthly from district and subdistrict facilities to the regional laboratory coordinator. Resupply amounts for the district and subdistrict levels are determined by the regional laboratory coordinator, and the reports are sent from the regional level to the central level.

**Figure 1. Laboratory Logistics Pipeline**



The MOH/GHS Institutional Care Division has the overall responsibility of managing the Ghana laboratory system. The central level is comprised of the Health Laboratory Services (HLS) and the PHRL. The HLS is the administrative component of laboratory services. The PHRL provides supervision to all other laboratories in the system, including the three zonal public health laboratories. Each of the 10 regions in Ghana has a designated regional laboratory. The peripheral level includes all the district and subdistrict facilities. Subdistrict facilities refer to public hospitals that are below the district level and health center laboratories. The numbers associated with each level in figure 2 depict the total number of laboratories found at each level. The number of functioning laboratories at the subdistrict level is currently unclear. Not all of the laboratories described below participate in HIV-related laboratory functions.

**Figure 2. Organizational Chart of Ghana Laboratory System**



## **FINDINGS OF THE LABORATORY LOGISTICS SYSTEM AND SERVICES ASSESSMENT**

The Ghana laboratory assessment team reviewed the laboratory system and services by interviewing key informants at different levels in the system. The key findings are described below. For more detailed findings, see appendix 4, Central and Regional Administrative Findings Table, and appendix 5, Facility Findings Table.

### **POLICIES**

The Ghana MOH and GHS have developed national policies for laboratory services that include the structure and organization of laboratory services, laboratory quality assurance, supervision, test menus by level, staffing requirements by level, health laboratory financing, and monitoring evaluation. These policies are in draft format. They have not been made final or disseminated, and very few laboratories were aware that the policies existed.

The PHRL has been instrumental in the development of national laboratory standard operating procedures (SOPs). In addition to step-by-step instructions for conducting a test, the SOPs also include equipment lists and general laboratory safety precautions. The SOPs do not cover information on post-exposure prophylaxis (PEP) for HIV or hepatitis B or give procedures for disposal of damaged or expired laboratory products. These SOPs have been developed for each level and have been disseminated. Most laboratories interviewed either had these available or were aware that they existed, but only a few facilities were aware of and put into practice the safety precaution section.

### **FINANCING**

At the national level, there are multiple funding sources for laboratory supplies. These sources are coordinated by the national budget committee (see appendix 6 for more detail about laboratory system donors). National funding for laboratory supplies is generally agreed to be insufficient.

Each facility is a budget management center (BMC), which means that financial management is the responsibility of the facility. The BMC is responsible for the finance and procurement of non-program-specific commodities for the facility, including laboratory supplies. In most facilities, a procurement committee determines the amount of facility funding to be allocated to laboratory supplies.

### **FORECASTING AND PROCUREMENT**

Annual forecasts are prepared by the Central Procurement Unit for program-specific supplies. The program-specific laboratory commodities include HIV test kits, TB supplies, meningitis test kits, and others. The annual forecasts for most of these supplies (but not HIV test kits) are based on test numbers from two years earlier, e.g., the forecast for 2006 was based on data from 2004. The previous year's data (in this case, 2005) were not used because the service statistics reports are not sent to the central level until after the forecast is prepared. The procurement of supplies that results from this forecast is not timely, and often the supplies procured are not adequate to meet the national demand.

At the facility level, forecasting for regularly consumed laboratory supplies (i.e., non-program-specific commodities that are not forecasted at the central level) is typically the responsibility of the laboratory in charge. Within the system, there is no norm for when forecasts are conducted; it

varies from facility to facility. Some laboratories develop a forecast for the year; others do it quarterly, monthly, or as needed. Once the forecast is developed, most laboratories send the list of requirements to the facility procurement committee. The procurement committee reviews, adjusts, and approves the list, which is then sent for procurement from private suppliers. The laboratory rarely has control over the budget (only one facility visited had complete control over the laboratory income and expenditure), and the procurement committee often decreases the amount of laboratory supplies for procurement, or substitutes other products, which may be technically inferior.

### **SUPERVISION, STAFFING, AND TRAINING**

All levels identified supervision of the laboratory system as a weakness. It was repeatedly stated that the supervision currently provided to the laboratory system is irregular and program-specific. Funding has not been regularly allocated for general supervision. Qualified laboratory staff are rarely included in supervisory teams for general health facilities. Additionally, the program-specific and/or general supervision that takes place does not typically include a review of logistics responsibilities (i.e., records and reports, physical inventory, inventory management, and so on). The on-the-job training (OJT) provided during supervision visits is, as expected, program-specific.

Nevertheless, some supervision strengths were identified. A supervision checklist has been developed by the central level for general health-related supervision. There is also program-specific supervision, which provides an opportunity for general interventions.

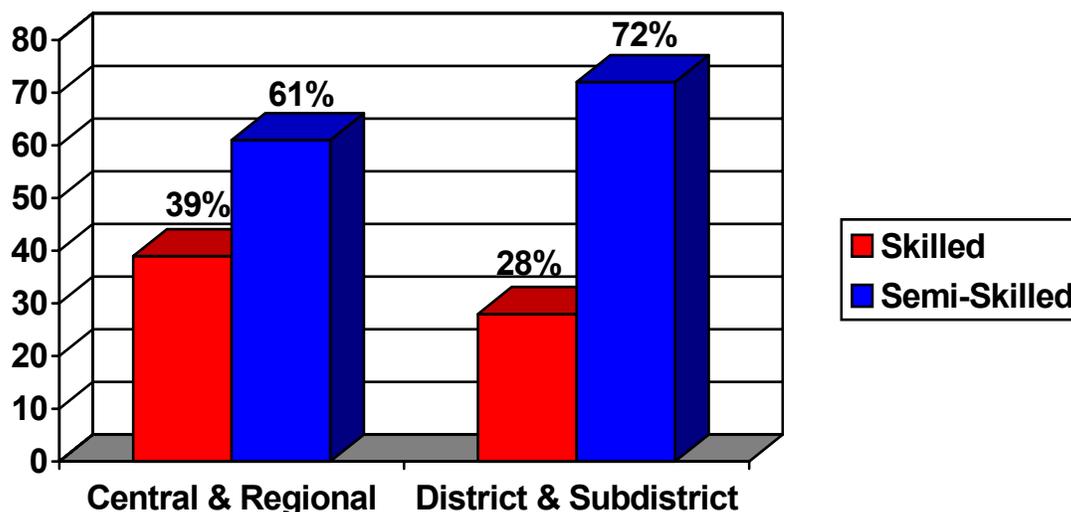
The draft policy document referred to above outlines appropriate staffing per level. The guidelines were generally agreed to be unrealistic, including requirements for the number of pathologists and microbiologists at the district level and above. The draft policy also requires that any facility at the subdistrict level have at least two technicians and eventually have one technologist and one technician. Using these criteria, only the central-level laboratory is adequately staffed.

The staffing levels were then reviewed according to criteria agreed upon by the assessment team. See appendix 7 for the number of staff per facility. The central and regional levels were found to be adequately staffed with skilled personnel, including biologists, biochemists, and technologists, as well as appropriate semiskilled staff.<sup>3</sup> At the district and subdistrict level, there was typically only one skilled staff member, although a few high-volume facilities had up to three skilled staff members. All facilities had more semiskilled than skilled staff, which is to be expected. The disparity between the number of semiskilled and skilled staff is much greater at the lower-level laboratories, as shown in figure 3. In total, 66 percent of the staff at the 30 facilities visited are semiskilled. The in-service training offered to staff is usually program-specific (the TB program offers extensive training), but the staff, especially semiskilled staff, do not receive regular training in laboratory procedures. In addition, there are a large number of interns compared with the number of permanent staff. Throughout the system, 30 percent of the total staff are not permanent, which contributes to a high risk of attrition.

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<sup>3</sup> Semiskilled staff include laboratory assistants, attendants, and others (interns or casual laborers). These staff were categorized as semiskilled because either they have not received formal training (were trained locally) or the training they received was a short certificate program. Skilled staff include laboratory technologists, biologists, biochemists, and technicians who have received formal extended training in laboratory practices.

**Figure 3. Skill Levels of Staff by Laboratory Level**



### **STORAGE AND DISTRIBUTION**

Storage capacity is adequate for the current stock levels of laboratory supplies throughout the system. It is uncertain if the storage capacity, including cold chain, will be adequate for rapid scale-up of laboratory services.

At the facility level, storage principles for laboratory supplies are not generally documented, and special considerations, such as separating flammable and caustic materials, were not routinely followed. The majority of the laboratories (25 out of 30 facilities) claimed to follow first-to-expire, first-out (FEFO); this was not easily confirmed because only small amounts of laboratory supplies are stored in the laboratory. The facility stores visited that stored some laboratory supplies followed FEFO. Expired products were typically separated from usable supplies but were not removed and disposed of. Most facilities had functioning cold chain storage, but the temperature was rarely monitored, and the power supply was not reliable to guarantee continuous cold storage.

Safety precautions for disposal of sharps were not always followed. In fact, it was noted at several facilities where an incinerator was not available that sharps were disposed of by bending and burying them. The sharps boxes that were used to dispose of sharps in the laboratories were intended for immunization programs and were not always adequately sized for laboratory sharps. Therefore, some facilities used boxes or bags to dispose of sharps. The majority of facilities, however, dispose of sharps in appropriate boxes and incinerate them. The disposal guidelines were facility specific, which means that facilities without a functioning incinerator<sup>4</sup> or burning pit devised their own disposal system, such as bend and bury.

As described in the snapshot of the current system, facilities generally are responsible for retrieving the program-specific supplies that are centrally procured. A common problem with this system is

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<sup>4</sup> Five out of 30 facilities did not have functioning incinerators or other acceptable waste management systems.

dependence on the availability and reliability of transportation. Although facilities generally have vehicles, the vehicles are not regularly available to the laboratory staff when needed.

### **LABORATORY INFRASTRUCTURE AND AVAILABILITY OF SUPPLIES**

The laboratories visited were generally found to be clean, well maintained, secured, ventilated, and well lit. The major problem area in laboratory infrastructure was the unreliability of both the water and power. Of the facilities visited, 37 percent had problems with water supply and 40 percent did not have consistent power. Of the 63 percent of facilities with consistent water supply, many used the Veronica bucket,<sup>5</sup> shown in appendix 8, to ensure adequate water supply, because tap water was not reliable. Drainage was identified as an area of concern; many facilities had open drainage in public areas. Finally, only 17 out of the 30 laboratories had functioning fire extinguishers although this is a mandatory safety precaution in a laboratory.

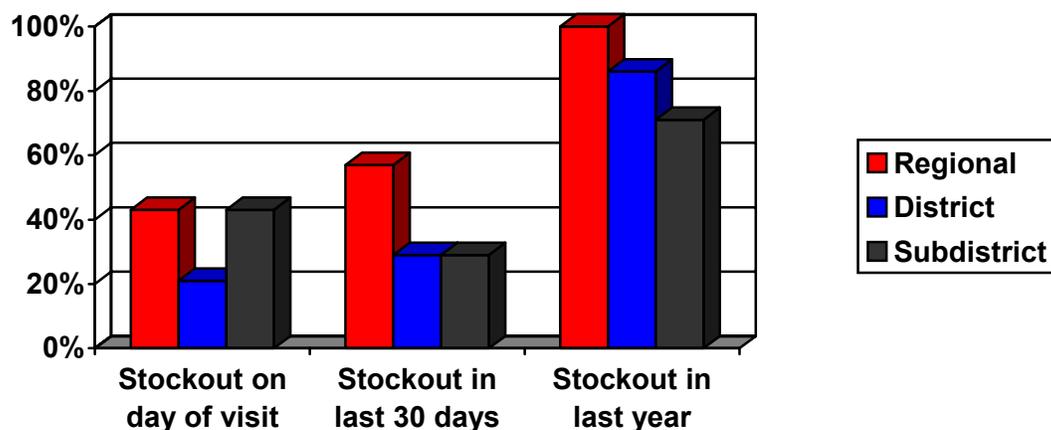
Only higher-level facilities (generally regional level) had automated equipment for hematology and chemistry. Much of this automated equipment is from one company, Taylor and Taylor, which generally has equipment maintenance schedules to follow and provides guidelines to the facilities. No maintenance schedules or records for other laboratory equipment were available at any level. When equipment not provided by Taylor and Taylor requires repair, the facility maintenance unit or district engineering/maintenance unit fix it.

The majority of facilities were fully stocked on the day of the visit (60 percent) and had been fully stocked for the previous month (67 percent). Many facilities reported short stockouts in the past year. Figure 4 shows the stockout rates by level. The supplies most commonly stocked out were hepatitis test kits. Some facilities also stocked out of consumables and infection control commodities. Stockouts occurred most frequently at the regional laboratories, and this was attributed to insufficient funding. The laboratory was not always reimbursed for the cost of the test, especially in the exemption programs (pregnant mothers, ART patients, children under five, and antenatal care), and the facility does not get reimbursed from the central level for these exemptions. In other words, the central-level policy states that pregnant mothers and patients on ART be provided with no-cost testing for certain tests, but the laboratory is required to procure the supplies for these tests without any financial support from the central level.

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<sup>5</sup> Mrs. Veronica Bekoe, PHRL, developed the Veronica bucket as a way to provide adequate water supply in laboratories that do not have consistent running tap water.

**Figure 4. Stockout Rates by Level**



### **LMIS AND INVENTORY MANAGEMENT**

A national policy for logistics management information systems (LMIS) and inventory management for all essential medicines (EMs), including laboratory supplies, defines maximum and minimum stock levels, but this policy is not followed for laboratory supplies.

Laboratory LMIS is limited to HIV test kits, which are managed through the PHRL (see figure 1) although some facilities were not aware of the maximum and minimum stock levels for HIV tests. Generally, tally cards (stock cards) are used at the store and requisition forms are used between the store and the laboratory and for the laboratory to place orders. The laboratories do not maintain stock cards.

A laboratory management information system (MIS) reports service statistics annually to the central level. This system does not include logistics data. There are no standardized forms in the system for collecting laboratory MIS although there are preprinted test request and report forms.

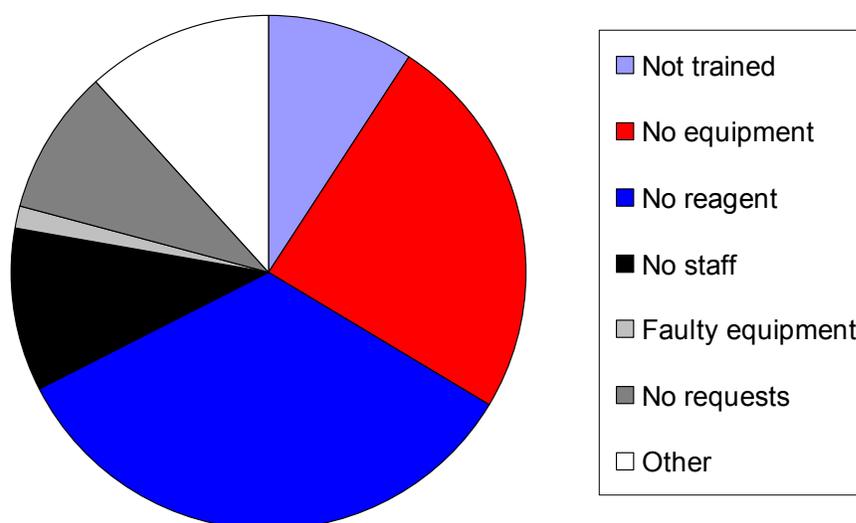
Laboratory supplies are typically managed through the facility store and not in the laboratory. The laboratory usually receives a small amount of inventory from the store on a regular basis, e.g., weekly. The laboratory staff usually determines the amount of supplies to order, but communication between the storekeeper and the laboratory about stock status is minimal. To determine order quantities, the laboratory staff must physically visit the facility store to ask for the current stock status or check the current stock status themselves. The laboratory staff are not regularly aware of the stock status in the stores to prevent stockouts. Order scheduling is determined by the facility. Some facilities order monthly, others order annually; there is no standard ordering schedule and procedures in the system. Emergency orders are not common because supplies are procured locally and the process is generally rapid.

TB reagents are generally reconstituted at a higher level. The facilities that reconstitute these reagents are trained to ensure the reconstitute is accurate. This process seems to work well in the system. No other programs or facilities require reconstitution of reagents at a higher level.

## LABORATORY TESTING SERVICES AND QUALITY ASSURANCE/QUALITY CONTROL

Although there was no finalized test menu by level to compare what was offered at the facilities, an agreed-upon list was developed by the team. The laboratories generally met the expected test menu by level. Some tests were not performed because of lack of trained staff, reagents, or equipment, or the test was not requested.<sup>6</sup> Figure 5 shows the number of times a facility mentioned any of the reasons for not performing the test; a facility may mention more than one reason per test. Of note is that lack of reagents and lack of equipment were the two most common reasons a test was not offered. The unavailability of reagents might occur because the test was not requested, with the result that reagents were not procured or the laboratory became stocked out of reagents.

**Figure 5. Reasons Tests Were Not Conducted**



Quality assurance/quality control (QA/QC) is necessary to ensure that the test results are accurate. External QA (EQA) monitors all aspects of the testing process. There was limited interlaboratory comparison testing; mostly it was program or facility specific. The TB program has a successful EQA with trained evaluators in each region. Other facilities participate in EQA with international evaluators. However, there is no defined national EQA system to ensure test results throughout the public laboratory system.

Internally, facilities generally followed limited QC procedures, including testing known positive and negative samples, regularly calibrating equipment, and cross-checking test results with colleagues. Commercially prepared controls, which provide positive and negative samples to test the validity of a reagent or test kit, are generally available in reagent test kits, but they are not a mandatory requirement when procuring test kits.

<sup>6</sup> The reason that a test is not requested could be twofold: the physician did not request the test because he or she was not aware that it was offered, or the physician was not in agreement with the need for this test.

# RECOMMENDATIONS AND SUGGESTIONS FOR SYSTEM STRENGTHENING

The recommendations that follow are suggestions for each topic discussed in the previous section on Findings of the Laboratory Logistics System and Services Assessment. The following chapter, Implementation Plan, describes the order and timing required for these recommendations.

## **POLICY**

- Strengthen, finalize, and disseminate national laboratory policies, including development of equipment lists by level, finalization of test menus by level, QA schemes and procedures, staffing by level, and safety precautions. This should be a collaborative effort with significant input from the field.
- Develop standard testing techniques by level that are agreed upon, disseminated, implemented, and advocated for with all hospital staff. This will help ensure that physicians and laboratory staff agree on the tests that are offered at each facility and that physicians order those tests when needed.
- Revise the technical SOPs by level to reflect the agreed-upon standard techniques. These should also include procedures on PEP for HIV and hepatitis B and for disposal of damaged and expired products. The SOPs should then be disseminated, staff trained in their use and contents, and the SOPs used during supervision as a guide.
- Include strengthening of laboratory services that support HIV/AIDS programs in the HIV/AIDS commodity security (HACS) strategy. The HACS has been a successful initiative to plan and organize all activities related to HIV/AIDS. Laboratory services should be included in all HACS planning activities.
- Make use of HIV and TB, and possibly malaria, programs to improve laboratory services. These programs have significant funding (see below), have functional programs, and require laboratory services. Laboratory services in general can be improved by using some of the resources available from these programs.

## **FINANCE**

- Use the HACS and/or TB program to review the costing of laboratory services at the national level. Many donors are interested in scaling up HIV and TB programs, including laboratory services. If the funding gaps for laboratory services are identified, HACS can be a platform to coordinate donors.

- Provide a separate budget line item for supplies at all levels for laboratory services. At the facility level, the procurement committee has the responsibility of allocating funding for laboratory supplies. Because this money is not separated from other funding, the funding for laboratory supplies is often decreased and supplies are not procured in full supply.
- Institute a national policy to ensure that funding generated from laboratories is allocated back to laboratory services at facilities. The funds generated by the laboratory are used for many other services in the facility, and a portion should be used (e.g., 70 percent of the revenue generated) for laboratory services and supplies.
- Reimburse laboratories, particularly at the regional level, for services provided to exemption programs. A major reason for stockouts at the regional level is the lack of funds to procure reagents because funds were not received for the exemption programs, which represent a significant proportion of the workload.

## **FORECASTING AND PROCUREMENT**

- Make forecasting more accurate by collecting current, appropriate data. Currently, no logistics data are used for forecasting program-specific supplies (except for HIV test kits) and the service statistics used are two years old. While service statistics are still being used for forecasting, the data should be collected and reported on a more regular basis so that they are available at the appropriate time for forecasting. Eventually, logistics data will be preferred to service statistics. Logistics data provide more accurate data about the usage of the supplies, while service statistics provide data about the number of tests conducted, which does not always easily correlate with the supplies required.
- Procure non-program-specific laboratory supplies according to standard testing techniques, by level. This means that the supplies procured should be only for the testing techniques approved in the national policy. Laboratory services will need to make a critical decision about where commodities will be procured—by the facility as currently is the case or by the central level. To make this decision, it is advisable to obtain comments from field staff and conduct studies about the advantages and disadvantages. Below are some advantages and disadvantages of central-level procurement:

### Advantages:

1. Standardization of test techniques and quality of supplies is ensured.
2. The procurement burden is taken from the field staff and given to the central level, relieving overburdened facility staff.
3. The central level will be able to have an economy of scale on purchases, thereby getting lower prices by procuring larger quantities.
4. Central procurement is in line with the integrated logistics system for essential drugs that the MOH is supporting and implementing; the laboratory supplies could easily be incorporated into the system currently being piloted.

5. Logistics data sent regularly will enable the central level to make informed decisions on procurement and resupply, and the data can be used for program monitoring and evaluation.

Disadvantages:

1. Transportation will be required to distribute supplies from the central level to the regional levels and then from the regional levels to the facilities on a regular basis. Otherwise, the facilities would have the large burden of retrieving supplies from the central level.
2. Transportation costs could be expensive and outweigh the financial advantages of central procurement. Further cost studies should be conducted to make this decision.
3. The increase of supplies would require significant storage requirements at the central level.
4. Logistics data would need to be sent regularly to the central level for making decisions on procurement and reorder supply amounts to facilities. This will require a motivated staff for reporting timely and accurate data.

## **SUPERVISION, STAFFING, AND TRAINING**

- Coordinate the general health system supervision format between all health system stakeholders, including laboratory services. The supervision teams that are formed must include qualified laboratory staff.
- Review the current supervision checklist and coordinate at central level with program-specific supervision to develop supervision teams and tools.
- Institutionalize the regional laboratory coordinator position. This position is key to successful supervision and management of the laboratory program, because this person will be tasked with overseeing all the laboratories in the region.
- Develop a plan to implement appropriate staffing by level and upgrade staffing levels at facilities to reflect this requirement.
- Develop structured OJT tools for supervisors and laboratory managers.
- Provide staff development programs to encourage continued education for current laboratory staff.

## **STORAGE AND DISTRIBUTION**

- Ensure storage capacity for program expansion. This may include a national storage capacity survey to guarantee space and cold chain storage for the laboratory supplies required for HIV/AIDS program expansion.
- Develop and distribute guidelines for proper storage of laboratory supplies. Proper storage guidelines, such as FEFO, separation and disposal of unusable items, and cold chain storage, should be reinforced during supervision.

- Require a review of safety procedures for disposal and destruction of sharps for all laboratory staff, including suggestions for appropriate disposal when incinerators are not available and for the use of sharps boxes. If funding is available, more appropriately sized sharps boxes should be procured and distributed to laboratories. The practice of bending needles and burying them must stop immediately. This practice exposes laboratory staff to an unacceptable high risk of HIV or hepatitis infection.
- Improve distribution capacity between central to regional and regional to facility. The details of this are dependent on the decision about procurement level. Also, as the EM distribution is rolled out to other regions, laboratory supplies from the central level should be included.

## **LABORATORY INFRASTRUCTURE AND AVAILABILITY OF SUPPLIES**

- Upgrade all laboratories to meet requirements as defined in the policy documents discussed above. This includes storage, laboratory area, and equipment, by level. This may require a national assessment of the laboratory infrastructure at each laboratory.
- Develop an equipment management plan, including maintenance schedules and equipment standardization requirements.

## **LMIS AND INVENTORY MANAGEMENT**

- Standardize the current laboratory MIS so that service statistics are reported regularly to the central level. As mentioned in the section above on Forecasting and Procurement, this will be useful for forecasting at the central level.
- Depending on the decision about what level procurement of non-program-specific supplies will be done, conduct a laboratory logistics system design, taking into account both the HIV test kit and the EM systems, and eventually train all staff on the agreed-upon system. The system design includes identification of inventory control (max-min stock levels at each level and reorder/review periods), LMIS (records and reports used to track logistics data, reporting intervals), decision-making points (for reordering, procurement, and so forth), and roles and responsibilities of all staff in the system and distribution.
- Strengthen logistics communication between store managers and laboratory staff. Until the logistics system is designed and rolled out, laboratory staff will need to continue making decisions about reorder quantities; to do so, the laboratory staff need key information from the storekeepers.
- Electronically network facilities at the district level and above to ease communication gaps. Simple email access will allow for more real-time responses to critical issues and encourage timely reporting.

## **TESTING SERVICES AND QUALITY ASSURANCE/CONTROL**

- See the section on Policy above for recommendations about test menus and SOPs. As mentioned above, these should be distributed to all facilities and particular attention should be given to sensitizing physicians to the appropriate tests offered by level.

- Develop standardized and documented procedures for internal and external QA/QC. This should be included in the national laboratory policies, and all laboratory staff should receive training in internal QC. When the testing techniques are standardized, form a national or regional peer group to compare test results. The PHRL should introduce procedures for EQA using the TB QA program as a model.
- Mandate a procurement policy that all test kits procured locally or centrally should include commercially prepared controls and adequate expiration dating.



# IMPLEMENTATION PLAN

Table 2 lists the recommended actions (described in more detail in the previous chapter) and the responsible parties and timeframes for each recommendation. This initial implementation plan can be used as a basis for more detailed planning for each activity. Further steps will need to be identified and followed for each action. It may be useful to split these activities by topic into subcommittees that will be responsible for the development of more detailed work plans.

**Table 2. Initial Implementation Plan**

Activity No.	Recommended Activity	Responsible Agency	Timeframe
1	Finalize decision on level (facility or central) responsible for procurement of non-program-specific lab supplies.	MOH/GHS	Before third quarter of 2006
2	Finalize national laboratory policies (including test menus, staffing allocation by level, QA schemes, etc.).	MOH/GHS/PHRL	Before end of 2006
3	Standardize testing techniques by level.	MOH/GHS/PHRL	Before end of 2006
4	Conduct a logistics system design workshop for laboratory supplies, based on decisions from activities 1 and 2.	PHRL	When policies and SOPs are finalized
5	Revise national SOPs by level, including PEP, and safety and disposal guidelines, and include storage, safe disposal, destruction of sharps, and external and internal quality control guidelines.	MOH/GHS/PHRL	Before end of 2006
6	Develop a plan to allocate staff to all facilities according to laboratory policy and develop continuing education plans.	MOH/GHS/PHRL	When policies and SOPs are finalized and before staff training starts
7	Disseminate national laboratory SOPs and policies and train staff on their use.	PHRL	When SOPs and policies are finalized

<b>Activity No.</b>	<b>Recommended Activity</b>	<b>Responsible Agency</b>	<b>Timeframe</b>
8	Develop and implement a laboratory MIS system that will give more timely and accurate service statistics (possibly quarterly reporting).	PHRL	Jointly with SOP dissemination and training
9	Review HIV and malaria program expansion plans to incorporate laboratory strengthening opportunities.	MOH/NACP	During program scale-up planning
10	Develop a system for separating the budget for laboratory supplies at the central and facility levels; establish a policy that a percentage of funds generated from the laboratory be allocated back to the laboratory.	MOH/GHS/PHRL/SSDM	During policy preparation, before end of 2006
11	Develop a plan to reimburse laboratories for costs of exemption programs; this can be included in the HACS work and in any maternal health program plan.	MOH/GHS/PHRL	During policy preparation
12	Develop supervision structure for health services, including incorporation of laboratory services; review current supervision checklist and development of laboratory-specific OJT tools.	MOH/GHS/PHRL	When policies and SOPs are finalized
13	Finalize regional laboratory coordinator position in the system structure.	MOH/GHS/PHRL	ASAP
14	Identify regional laboratory coordinators and give official title for position.	MOH/GHS/PHRL	Following activity 13
15	Assess storage capacity throughout the system to ensure adequacy for program expansion plans, including storage for decision from activity 1.	PHRL	Immediately to ensure this step is completed for ART scale-up
16	Develop plan to improve transportation between all levels in	PHRL	Done jointly with storage

<b>Activity No.</b>	<b>Recommended Activity</b>	<b>Responsible Agency</b>	<b>Timeframe</b>
	the system, including information from decision in activity 1.		
17	Upgrade all laboratories to meet requirements developed in policy documents in activity 2; this may require a national assessment of laboratory infrastructure for each facility.	MOH/GHS	Put in HACS strategy implementation
18	Develop an equipment management plan, including maintenance schedules and guidelines for standardization of equipment.	PHRL	Put in HACS strategy implementation
19	Computerize and/or network facilities down to the district level.	PHRL	2007
20	Implement EQA scheme and train laboratory staff.	PHRL	2007



# CONCLUSIONS

This assessment was representative of the laboratory system related to CT, VCT, PMTCT, sentinel sites, and ART sites. The goal was to provide overall system recommendations but not facility-specific interventions.

The Ghana laboratory logistics system and services assessment presents many positive findings and strengths of the current system:

- The Ghana MOH and GHS have developed national policies for laboratory services that address major areas of laboratory services.
- SOPs have been developed for each level, have been disseminated, and are in use.
- Multiple funding sources for laboratory supplies exist at the national level and are coordinated by the national budget committee.
- Annual forecasts are prepared by the Central Procurement Unit for program-specific supplies, and a procurement committee is in charge of the final procurement decisions.
- Storage capacity is adequate for the current stock levels of laboratory supplies throughout the system.
- The laboratories visited were generally found to be clean, well maintained, secured, ventilated, and well lit.
- The majority of facilities were fully stocked on the day of the visit and had been fully stocked for the month preceding the visit.
- Laboratory MIS reports service statistics annually to the central level.

Since no system is perfect, there are some areas that can benefit from improvement:

- The national laboratory policies have not been completed or disseminated, and very few laboratories are aware that these policies exist.
- Only a few facilities were aware of and put into practice the safety precaution section of the SOPs.
- SOPs do not include information on PEP or procedures for disposal of damaged and expired laboratory products.
- National funding for laboratory supplies is generally agreed to be insufficient.
- The procurement of supplies is not timely; the supplies procured often are not adequate to meet the national demand because forecasts are based on stale data.

- At the facility level, forecasting for regularly consumed laboratory supplies follows no norm and varies from facility to facility. The laboratory rarely has control over the budget.
- Supervision currently provided to the laboratory system is irregular and program specific because of insufficient funding and does not usually include a review of logistics responsibilities.
- It is uncertain if the storage capacity, including cold chain, will be adequate for rapid scale-up of laboratory services. At the facility level, storage principles for laboratory supplies are not generally documented and not always routinely followed.
- The major problem area in laboratory infrastructure is the unreliability of both water and power.
- There are no maximum and minimum levels set for laboratory commodities, and some facilities reported short stockouts in the last year, especially for hepatitis test kits. Stockouts occurred most frequently at the regional laboratories because of insufficient funding.
- Information reported through the laboratory MIS does not include logistics data.
- Except for the TB program, there is no defined national EQA system to ensure test results throughout the public laboratory system.

The most important recommendations made by the assessment team are related to policies. It is crucial to strengthen, finalize, and disseminate national laboratory policies, which should include the development of equipment lists by level, finalization of test menus by level, QA schemes and procedures, staffing by level, and safety precautions. The next step requires the dissemination and implementation of the policies and revised SOPs.

The focus on policies should be a collaborative effort with significant contributions from the field. Any strategies developed and actions to be taken will require a substantial involvement of all stakeholders and a great amount of resource mobilization from the Government of Ghana and from donors. This work will necessitate the coordination of donors, service providers, and system managers.

# REFERENCES

- Ministry of Health/Institutional Care Division. October 2000. *Policy for National Health Laboratories (3<sup>rd</sup> Draft)*. Accra, Ghana: Health Laboratory Services Headquarters, Korle-Bu Teaching Hospital.
- Ministry of Health/Ghana Health Services. January 2006. *Towards Universal Access to Antiretroviral Therapy, Ghana National Scale Up Plan*. n.d. Accra, Ghana: Ministry of Health/Ghana Health Services.
- Ministry of Health/Ghana Health Services. *Protocol for HIV Testing*. n.d. Accra, Ghana: Health Laboratory Services Headquarters, Korle-Bu Teaching Hospital.
- Ministry of Health/Ghana Health Services. *National Standard Operating Procedures for Laboratory Services*. n.d. Accra, Ghana: Health Laboratory Services Headquarters, Korle-Bu Teaching Hospital.



# APPENDIX 1: TRIP ITINERARY

Date	Time	Activities	Place	Participants
March 11	p.m.	-Team arrival from DC: Ron & Wendy	Accra	Picked up at the airport by Smaila to Shangri-La
March 13	9:00 a.m.	-Briefing with DELIVER resident adviser	DELIVER-Office	Ron, Wendy, Egbert, Parfait
	9:30 a.m.	-Briefing at the Mission	USAID	Ron, Wendy, Parfait
	11:00 a.m.	-Briefing meeting with Mr. Boateng	MOH	Ron, Wendy, Parfait
	2:30 p.m.	-Briefing meeting with Mrs. Bekoe	PHRL	Ron, Wendy, Parfait, Egbert
March 14	9:00–11:30 a.m.	-Presentation of the objectives and the ATLAS to the team members	GRMA Conference room (DELIVER building)	Ron, Wendy, Egbert, Parfait, and two MOH/GHS staff
	1:00–5:00 p.m.	-Revision of the ATLAS with the country team members and DELIVER team -Print copies for field test	GRMA (DELIVER)	Ron, Wendy, Egbert, Parfait, and two MOH/GHS staff
March 15	9:30 a.m.–5:00 p.m.	-Field test	Accra	Ron, Wendy, Egbert, two MOH/GHS staff
March 16	9:30 a.m.–5:00 p.m.	-Field test results discussion and finalization of the ATLAS	GRMA	Ron, Wendy, two MOH/GHS staff
March 17	9:30–11:00 a.m.	-Presentation of the final version of the ATLAS to the stakeholders and sampling	GRMA	Ron, Wendy, Aoua, Egbert, Parfait, Mr. Boateng, Dr. Nii Addo, Mrs. Bekoe, two MOH/GHS staff
	2:00–5:00 p.m.	-Printing of the ATLAS -Composition of the teams -Preparation for field visit	GRMA	Ron, Wendy, Aoua, Egbert, two MOH/GHS staff
March 19	10:00 a.m.	-Departure for field visit	From Shangri-La	Ron, Wendy, Aoua, two MOH/GHS staff, Egbert
March 20-	9:00 a.m.–	-Data collection	Field	Ron, Wendy, Aoua, two

<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Place</b>	<b>Participants</b>
24	5:00 p.m.			MOH/GHS staff, Egbert
March 25	5:00 p.m.	-Return from the field		Ron, Wendy, Aoua, two MOH/GHS staff, Egbert
March 27-29	9:00 a.m.– 5:00 p.m.	-Data analysis -Preparation for the debriefing (draft result)	GRMA	Ron, Wendy, Aoua, two MOH/GHS staff, Egbert, Parfait
March 30	9:30 a.m.– noon	-Finalization of the debriefing preparation	GRMA	Ron, Wendy, Aoua, two MOH/GHS staff, Egbert, Parfait
	2:00 p.m.	-Joint debriefing with all the stakeholders and USAID	Kama Conference Centre	Ron, Wendy, Aoua, two MOH/GHS staff, Egbert, Parfait
March 31	9:00 a.m.– 3:00 p.m.	-Preparation of the technical assistance report	DELIVER office	Ron, Wendy, Aoua
	Evening of April 1	-Departure of the team to USA		Ron, Wendy, Aoua

# APPENDIX 2: FIELD VISIT SCHEDULE

## TEAM 1—UPPER EAST & NORTHERN REGIONS, WENDY AND SRODA

- Sunday
  - 6:30 a.m. Depart for Bolgatanga
  - Sleep in Bolgatanga
- Monday
  - 8:30 a.m. Bolgatanga Hospital
  - 11:00 a.m. Depart for Bawku
  - 1:00 p.m. Bawku Presbyterian Hospital
  - Sleep in Bolgatanga
- Tuesday
  - 8:00 a.m. Depart for Tongo Sandema
  - 9:00 a.m. Tongo Health Centre
  - 11:00 a.m. Depart for Sandema
  - 1:00 p.m. Sandema District Hospital
  - 3:00 p.m. Depart for Bolgatanga
  - Sleep in Bolgatanga
- Wednesday
  - 7:00 a.m. Depart for Tamale
  - 9:00 a.m. Tamale Regional Hospital
  - 11:00 a.m. Depart for Salaga
  - 1:00 p.m. Salaga Governmental Hospital
  - Sleep in Tamale
- Thursday
  - 9:00 a.m. Depart for Yendi

- 11:00 a.m. Adibo Health Center
- 2:00 p.m. Depart for Tamale
- Friday
  - 8:00 a.m. Depart for Damongo
  - 10:00 a.m. West Gonja Hospital
  - 12:00 noon Depart for Kumasi
  - Sleep in Kumasi
- Saturday
  - Depart for Accra

## **TEAM 2—ASHANTI & CENTRAL REGIONS, RON AND EGBERT**

- Sunday
  - Sleep in Swedu
- Monday
  - 8:00 a.m. Swedu Hospital
  - 10:00 a.m. Depart for Cape Coast
  - 12:30 p.m. Central Regional Hospital
  - Sleep in Cape Coast
- Tuesday
  - 8:00 a.m. Depart for Twifu
  - 10:00 a.m. Twifu Oil Palm Plantation Clinic
  - 12:00 noon. Depart for Assin Fuso
  - 3:00 p.m. Assin Fuso
  - 4:30 p.m. Depart for Obuasi, sleep in Obuasi
- Wednesday
  - 8:00 a.m. Obuasi Government Hospital
  - 10:00 a.m. Depart for Kumasi
  - 12:00 noon Asonomanso Health Center
  - Sleep in Kumasi

- Thursday
  - Kumasi South Hospital
  - Sleep in Kumasi
- Friday
  - 8:00 a.m. Depart for Juaso
  - 9:30 a.m. Juaso District Hospital
  - Depart for Accra

### **TEAM 3—VOLTA & EASTERN REGIONS, AOUA AND ROWLAND**

- Sunday
  - Sleep in Aflao
- Monday
  - 8:00 a.m. Aflao Governmental Hospital
  - 11:00 a.m. Depart for Ho
  - 12:30 p.m. Ho Regional Hospital
  - 3:30 p.m. Depart to Hohoe, sleep in Hohoe
- Tuesday
  - 7:00 a.m. Depart Hohoe for Dodi Papase
  - 9:00 a.m. Dodi Papase Hospital,
  - 11:00 a.m. Depart for Jasikan
  - 12:30 p.m. Jasikan Governmental Hospital
  - 3:30 p.m. Depart for Atimpoku, sleep in Atimpoku
- Wednesday
  - 8:00 a.m. Depart for Atua
  - 8:45 a.m. Atua Government Hospital
  - 11:00 a.m. Depart for Koforidua
  - 12:00 noon Koforidua Regional Hospital, sleep in Koforidua
- Thursday
  - 8:00 a.m. Depart for New Abrim

- 10:00 a.m. New Abrim Health Center
- 3:00 p.m. Arrive back in Koforidua
- Friday
  - 8:00 a.m. Depart for Nsawam
  - 9:00 a.m. Nsawam Hospital
  - Depart for Accra

# APPENDIX 3: GHANA FACILITIES LIST

<b>Facility</b>	<b>District</b>	<b>Region</b>
Akrokeri Health Center	Adansi North	Ashanti
New Edubiase Hospital	Adansi South	Ashanti
Asaamang Sda Hospital	Afigya Sekyere	Ashanti
Tepa Government Hospital	Ahafo Ano North	Ashanti
Mankranso Hospital	Ahafo Ano South	Ashanti
Jacobu Catholic Hospital	Amansie Central	Ashanti
Bekwai Hospital	Amansie East	Ashanti
Kokofu Hospital		Ashanti
Dominase Sda Hospital		Ashanti
Agroyesum Catholic Hospital	Amansie West	Ashanti
Konongo Hospital	Asante Akim North	Ashanti
Agogo Presbyterian Hospital		Ashanti
Juaso Hospital	Asante Akim South	Ashanti
Nyinahin Hospital	Atwima Mponua	Ashanti
Nkawie-Toase Hospital	Atwima Nwabiagya	Ashanti
Kuntanase Hospital	Bosomtwe Atwima K.	Ashanti
Pramso Catholic Hospital		Ashanti
Ejisu Health Center	Ejisu-Juaben	Ashanti
Juaben Hospital		Ashanti
Ejura Hospital	Ejura-Sekyedumase	Ashanti
Kasei St. Lukes		Ashanti
Public Health Laboratory	Kumasi	Ashanti
Kumasi South Hospital	Kumasi	Ashanti
Suntreso Hospital	Kumasi	Ashanti
Manhyia Hospital	Kumasi	Ashanti
MCH Hospital	Kumasi	Ashanti
Tafo Hospital	Kumasi	Ashanti
Kwadaso SDA Hospital	Kumasi	Ashanti

<b>Facility</b>	<b>District</b>	<b>Region</b>
Knust Hospital	Kumasi	Ashanti
Bomso Clinic		Ashanti
Ankaase Methodist Hospital	Kwabre	Ashanti
Asonomaso Hospital		Ashanti
Mampong Health Center		Ashanti
Obuasi Government Hospital	Obuasi	Ashanti
Anglogold Hospital		Ashanti
Bryant Mission		Ashanti
Offinso St. Patrick Hospital	Offinso	Ashanti
Njenkasu Hospital		Ashanti
Effiduase Hospital	Sekyere East	Ashanti
Mampong Hospital	Sekyere West	Ashanti
Sunyani Regional Hospital	Sunyani	Brong-Ahafo
Holy Family Catholic Hospital	Berekum	Brong-Ahafo
Presbyterian Hospital	Dormaa	Brong-Ahafo
Sampa Government Hospital	Jaman North	Brong-Ahafo
St. Mary's Hospital, Drobo	Jaman South	Brong-Ahafo
Wenchi Methodist Hospital	Wenchi	Brong-Ahafo
Holy Family Catholic Hospital	Techiman	Brong-Ahafo
Ahmadiyaa	Techiman	Brong-Ahafo
St. Elizabeth Hospital	Asutifi	Brong-Ahafo
Goaso Government Hospital	Asunafo	Brong-Ahafo
St. Theresa's Hospital	Nkoranza	Brong-Ahafo
Atebub Government Hospital	Atebub	Brong-Ahafo
Mathias Hospital, Yeji	Pru	Brong-Ahafo
St. John of God, Duayaw-Nkwanta	Tano North	Brong-Ahafo
Bechem Government Hospital	Tano South	Brong-Ahafo
Kintampo Government Hospital	Kintampo	Brong-Ahafo
Cape Coast Regional Hospital	Cape Coast	Central
Cape Coast Municipal Hospital	Cape Coast	Central
Saltpond Government Hospital	Mfantiman	Central
Apam Catholic Hospital	Gomoa	Central
Swedru Government Hospital	Agona	Central

<b>Facility</b>	<b>District</b>	<b>Region</b>
Our Lady of Grace Asikuma Catholic Hospital	Asikuma-Odoben-Brakwa	Central
St. Francis Xavier Hospital Assin Foso	Assin	Central
Twifo Oil Palm Plantation Clinic	Twifo Hemang Lower Dnekyira	Central
Dunkwa-on-Offin	Upper Denkyira	Central
Abura Dunkwa Hospital	Abura-Hsebu-Kwamankese	Central
Ajumako Hospital	Ajumako Enyan Essiam	Central
Koforidua Regional Hospital	New Juabeng	Eastern
St. Joseph Hospital, Koforidua	New Juabeng	Eastern
Nsawam Hospital	Akwapin South	Eastern
Tetteh Quarshie Hospital	Akwapin North	Eastern
Suhun Government Hospital	Suhum Kreba	Eastern
Presbyterian Mission Hospital	Kwahu North	Eastern
Atibie Government Hospital	Kwahu South	Eastern
District Health Management Team	Atiwa	Eastern
New Abrim Health Center	Brim North	Eastern
Oda Government Hospital	Brim South	Eastern
Asamankese Government Hospital	West Akim	Eastern
Tafo Government Hospital	East Akim	Eastern
Begoro Hospital	Fanteakwa	Eastern
Kade Health Center	Kwaeibirim	Eastern
St. Dominic Hospital		Eastern
G.C.D. Akwatia		Eastern
Vra, Akosombo	Asuogyamang	Eastern
Kibi Government Hospital	East Akim	Eastern
Atua Government Hospital	Manya Krobo	Eastern
DHMT	Yilo	Eastern
Akuse Government Hospital	Manya Krobo	Eastern
Asewewa Government Hospital		Eastern
St. Martin's Hospital		Eastern
Holy Family Catholic Hospital	Kwahu West	Eastern
Achimota Hospital		Greater Accra

<b>Facility</b>	<b>District</b>	<b>Region</b>
Adabraka Polyclinic		Greater Accra
Kanshie Polyclinic		Greater Accra
La Polyclinic		Greater Accra
Maamobi Polyclinic		Greater Accra
Mamprobi Polyclinic		Greater Accra
Princess Marie Louis Hospital		Greater Accra
Ussher Polyclinic		Greater Accra
Ridge Hospital		Greater Accra
Dodowa Health Center		Greater Accra
Amasaman Health Center		Greater Accra
Team Polyclinic		Greater Accra
Tema General Hospital		Greater Accra
Public Health Laboratory	Tamale	Northern
Baptist Medical Center, Nalerigu	East Mamprusi	Northern
Abibo Health Center	Yendi	Northern
Salaga Government Hospital	East Gonja	Northern
West Gonja Hospital	West Gonja	Northern
Bolgatanga Regional Hospital	Bolgatanga	Upper East
Presbyterian Hospital	Bawku East	Upper East
Zebilla Government Hospital	Bawku West	Upper East
Navrongo War Memorial Hospital	Kassena-Nankana	Upper East
Sandema Government Hospital	Builsa	Upper East
Wiaga Catholic Clinic	Builsa	Upper East
Bongo Government Hospital	Bongo	Upper East
Tongo Health Center	Talensi-Nabdam	Upper East
Jirapa Hospital	Jirapa/Lambuisi	Upper West
Lawra Hospital	Lawra	Upper West
Nandom Hospital	Lawra	Upper West
Nadowli Hospital	Nadowli	Upper West
Wa Hospital	Wa	Upper West
Tumu Hospital	Sissala East	Upper West
Ho Municipal Hospital	Ho	Volta
Aflao Government Hospital	Ketu	Volta

<b>Facility</b>	<b>District</b>	<b>Region</b>
Aflao Central Hospital	Ketu	Volta
Keta Government Hospital	Keta	Volta
Sogakope Government Hospital	South Tongu	Volta
Combani Hospital	South Tongu	Volta
St. Paul's Hospital	South Tongu	Volta
Adidome Government Hospital	South Tongu	Volta
Ho Regional Hospital	Ho	Volta
Peki Government Hospital	South Dayi	Volta
Hohoe Government Hospital	Hohoe	Volta
Anfoega Government Hospital	Kpandu	Volta
Dzooze Catholic Hospital	Ketu	Volta
Battor Catholic Hospital	North Tongu	Volta
Kadjebi Government Hospital	Kadjebi	Volta
Abor Government Hospital	Keta	Volta
Margaret Marquart Hospital	Kpandu	Volta
Jasikan Government Hospital	Jasikan	Volta
Nkwanta Government Hospital	Nkwanta	Volta
Nkwanta Catholic Hospital	Nkwanta	Volta
Worawora Government Hospital	Jasikan	Volta
Dodi Papase Hospital	Kadjebi	Volta
Krachi Government Hospital	Krachi	Volta
Takoradi Hospital	Saema	Western
Axim Hospital	Nzema East	Western
Eikwe Hospital	Nzema East	Western
Half Assini Hospital	Jomoro	Western
Tarkwa Government Hospital	Wassa West	Western
Prestea Government Hospital	Wassa West	Western
Wassa Akropong Hospital	Wassa Amenfi East	Western
Asnakraguwa Hospital	Wassa Amenfi West	Western
Enchi Hospital	Aowin Suaman	Western
Sefwi Asafo Hospital	Sefwi Wiawso	Western
Sefwi Wiawso Hospital	Sefwi Wiawso	Western
Bibiani Hospital	B.A.B	Western

<b>Facility</b>	<b>District</b>	<b>Region</b>
Ahmadiya Hospital	M. Wassa East	Western
Dixcove Hospital	Ahanta West	Western
Siwam Clinic	Jomoro	Western
Public Health Laboratory	Saema	Western
Juabaso	Juabaso	Western

# APPENDIX 4: CENTRAL AND REGIONAL ADMINISTRATIVE FINDINGS TABLE

Logistics Components	Central and Regional Administrative Findings
Organization/ Policy	<ul style="list-style-type: none"> <li>-National policies for lab services are prepared but have not been finalized and disseminated. These policies cover many areas, including structure and organization of lab services, staffing, test menu by level, and so on.</li> <li>-National SOPs have been developed and disseminated. In addition to SOPs for testing, these include SOPs on safety precautions and QA, but they do not cover PEP and disposal of damaged/expired goods.</li> </ul>
Forecasting & Procurement	<ul style="list-style-type: none"> <li>-A central procurement unit is responsible for annual forecasting and procurement of program-specific lab supplies.</li> <li>-The central program-specific procurements have not been adequate or timely because of lack of data for demand estimation.</li> <li>-Each facility is a BMC (budget management center) responsible for finance and local procurement of non-program-specific commodities.</li> </ul>
Financing	<ul style="list-style-type: none"> <li>-Many sources of funding are available for lab services (government, donors, user’s fees), and the national budget committee coordinates all funding sources.</li> <li>-The available funds, however, are not sufficient to cover the needs for laboratory supplies and equipment.</li> </ul>
Storage & Distribution	<ul style="list-style-type: none"> <li>-There is adequate storage capacity for current storage requirements, but it is uncertain if current cold chain capacity can meet requirements of program scale-up.</li> <li>-Distribution between the central and regional level is based on availability of supplies, and vehicles for transportation are not reliable.</li> </ul>
Inventory Control System	<ul style="list-style-type: none"> <li>-There is a national policy defining max-min stock levels, but this is not applied in the system.</li> <li>-Stock levels are not monitored below the central level.</li> </ul>

<b>Logistics Components</b>	<b>Central and Regional Administrative Findings</b>
Laboratory LMIS	<ul style="list-style-type: none"> <li>-A functional logistics MIS is limited to HIV tests.</li> <li>-Annual reports are received from regions with service statistics (tests performed), but these do not include logistics data.</li> </ul>
Supervision	<ul style="list-style-type: none"> <li>-There is a supervision checklist, but supervision tends to be program specific and is not adequate because of the lack of specialists in each program within the supervisory team.</li> </ul>
Other Areas of Concern	<ul style="list-style-type: none"> <li>-There is no structured continuing education program for laboratory personnel.</li> <li>-QA programs are program specific (primarily TB).</li> <li>-IT networking is weak from central to regional laboratories.</li> </ul>

# APPENDIX 5: FACILITY FINDINGS TABLE

Logistics Components	Findings at the Facility Level
Staffing and Training	<ul style="list-style-type: none"> <li>-The PHRL and regions have adequate staff, but there is a high risk of attrition because of the large number of interns versus permanent staff; 30 percent of total staff in the system are not permanent.</li> <li>-There is no structured OJT for staff; OJT is all program-specific.</li> <li>-Facilities that have been upgrading to district hospitals do not meet staffing requirements for the district level.</li> <li>-There are not enough formally trained staff at the district and subdistrict level. Health centers often have only one or two people providing all lab services.</li> <li>-Sixty-six percent of the staff in the system are lab assistants, attendants, or interns/casuals with no formal training.</li> </ul>
National Guidelines and Protocols	<ul style="list-style-type: none"> <li>-Labs below central level are generally unaware of national laboratory policies.</li> <li>-The national SOPs have been distributed and are generally in use. Some facilities use only test techniques and do not use safety precaution SOPs.</li> </ul>
Supervision	<ul style="list-style-type: none"> <li>-Supervision is program specific and irregular; it does not usually include review of logistics records, and physical inventory of commodities because those activities are managed by storekeepers.</li> </ul>
Quality Assurance	<ul style="list-style-type: none"> <li>-Most facilities have limited QC procedures, including for the testing of known positive and negative samples, calibration, and cross-checking with colleagues. Commercially prepared controls are usually available in reagent test kits.</li> <li>-External QA is usually program specific. Some facilities participate in an international external QA scheme.</li> </ul>

Logistics Components	Findings at the Facility Level
Laboratory Supplies Logistics	
<ul style="list-style-type: none"> <li>Inventory Management</li> </ul>	<ul style="list-style-type: none"> <li>-Defined stock levels are restricted to HIV tests in central and regional levels. Facilities have minimal defined stock levels even for HIV tests.</li> <li>-Inventory management is typically at the stores, not in the laboratory.</li> <li>-Lab staff calculates the order quantities, but quantities to be procured are generally determined by the hospital administration.</li> <li>-There are no standard ordering schedules and procedures throughout the system; they are defined by facility.</li> <li>-Reconstitution of reagents at a higher level is restricted to TB reagents and is done to control the quality of the reagents.</li> <li>-Emergency orders were not common because the facilities procure the supplies locally through the facility procurement committee.</li> </ul>
<ul style="list-style-type: none"> <li>LMIS</li> </ul>	<ul style="list-style-type: none"> <li>-Generally, tally cards (at the stores only) and requisition forms were found at the facilities; the information from these LMIS forms is used for resupply.</li> <li>-HIV test LMIS data is designed to be sent monthly. Most facilities report monthly, but some admitted to sending reports quarterly.</li> <li>-Generally, lab staff report on tests performed to facility administrators, but the reporting schedule is not standardized throughout the system. The region prepares an annual report that is sent to the central level.</li> <li>-Facilities generally have standard preprinted forms for test requests and report.</li> </ul>
<ul style="list-style-type: none"> <li>Transport</li> </ul>	<ul style="list-style-type: none"> <li>-Although facilities generally have vehicles, they are not regularly available to the laboratory staff.</li> <li>-Lab supplies are generally picked by the facility from the higher level.</li> <li>-Products from private suppliers are picked or delivered depending on the facility.</li> </ul>
<ul style="list-style-type: none"> <li>Availability of Supplies</li> </ul>	<ul style="list-style-type: none"> <li>-Not many facilities experienced stockouts on the day of the visit (30 percent) or within the last month (33 percent), but a large number (87 percent) of facilities experienced a stockout in the last year.</li> <li>-The majority of these stockouts were reagents, followed by consumables and infection control.</li> <li>-Duration of stockouts was generally short.</li> <li>-Regional labs experienced the most stockouts because funding is not enough to procure supplies for the large number of tests and customers given exemptions (free services).</li> </ul>

Logistics Components	Findings at the Facility Level
	<p>-Sharps boxes at some regional level facilities were not appropriately sized (originally for Expanded Programme on Immunization) and many regional hospitals used self-made sharps boxes.</p>
<ul style="list-style-type: none"> <li>• Storage Conditions</li> </ul>	<p>-No documented lab supplies guidelines are provided for storage and disposal of expired/damaged products, although some labs have DELIVER storage guidelines.</p> <p>-FEFO was not easily observed because of small quantities of items in the lab.</p> <p>-Flammable and caustic materials were generally not separated.</p> <p>-Expired products were usually separated but not regularly removed and disposed of.</p> <p>-Most facilities have cold chain storage, but power supply was not reliable to maintain the cold storage.</p> <p>-Temperature in cold chain storage is not monitored.</p>
<ul style="list-style-type: none"> <li>• Lab Area</li> </ul>	<p>-Generally, lab areas are clean, well maintained, secured, ventilated, and well lit, and windows and doors were in good condition.</p> <p>-There were problems with reliable water (37 percent) and power (40 percent) supply.</p> <p>-Open drainage was a common feature.</p> <p>-Fire extinguishers were not available at all facilities.</p> <p>-Five of 30 (four health centers and one district hospital) facilities did not have functioning incinerators or acceptable waste management system.</p>
<p>Lab Testing Services</p>	<p>-These services generally meet the expected test menu by level.</p> <p>-Some tests are not performed because of lack of trained staff, reagents, or equipment, or the tests are not requested.</p> <p>-Physicians' requests and level of staff dictate the test menu.</p>
<p>Equipment Availability and Maintenance</p>	<p>-Taylor and Taylor has maintenance schedules for its equipment.</p> <p>-No maintenance schedules or records are provided for other equipment.</p> <p>-Facilities repair equipment but do not maintain it; maintenance is done by either the facility maintenance unit or district engineering/maintenance unit.</p> <p>-Voltage stabilizers are needed to help maintain equipment against power fluctuations.</p>
<p>Other Areas of Concerns</p>	<p>-Funding generated from labs is not allocated back to improving lab services.</p>



# APPENDIX 6: LABORATORY SYSTEM PARTNERS

Global Fund	Procurement of ARVs, equipment, test kits, initial CD4 reagents, and TB and malaria commodities; provision of tender support and training
MAP (World Bank), DFID, and Netherlands	Support activities for HIV/AIDS
TAP (World Bank)	Scale-up of private sector, training, and some funding to the GOG basket
USAID	TA, capacity building
DFID	Procurement of HIV tests – previously
JICA	ART clinical training
Clinton Foundation	Price negotiations
WHO/FHI	Training, TA, clinical guidelines
FHI	Assist in clinical aspects of ART pilot sites and private sector and standard clinical guidelines



# APPENDIX 7: STAFFING SUMMARY BY FACILITY AND BY AVERAGE PER LEVEL

Facilities		Categories and Number of Staff						Total Staff per Facility	Average Staff per Level
		<i>Technologists</i>	<i>Biologists/Biochemists</i>	<i>Technicians</i>	<i>Assistants</i>	<i>Attendants</i>	<i>Others</i>		
Central Level Lab, PHRL		4	5	3	1	0	2	<b>15</b>	<b>15</b>
Public Health Lab, Tamale		2	0	1	0	1		<b>4</b>	<b>4</b>
Regional Laboratories	Ho	2	1	2	2	0	8	<b>15</b>	<b>14</b>
	Koforidua	4	1	0	1	7	13	<b>26</b>	
	Tamale	2	1	1	4	2	11	<b>21</b>	
	Bolgatanga		1	3	2	1	3	<b>10</b>	
	Cape Coast	2	1	0		2	5	<b>10</b>	
	Kumasi		1	1	2		1	<b>5</b>	
	Ridge (Accra)	2	1	5	0	1	4	<b>13</b>	
District Laboratories	Aflao	1	0	1	4	1	1	<b>8</b>	<b>6</b>
	Atua	1	1	0	1	0	1	<b>4</b>	
	Nsawan	1	0	2	1	2	1	<b>7</b>	
	Yendi	0	0	1	3	0	1	<b>5</b>	
	Salaga	0	0	0	2	1	0	<b>3</b>	

Facilities		Categories and Number of Staff						Total Staff per Facility	Average Staff per Level
		<i>Technologists</i>	<i>Biologists/ Biochemists</i>	<i>Technicians</i>	<i>Assistants</i>	<i>Attendants</i>	<i>Others</i>		
	West Gonja	1	0	0	3	1	0	<b>5</b>	
	Sandema	0	0	1	1	0	0	<b>2</b>	
	Bawku Presby	1	0	1	5	2	1	<b>10</b>	
	Swedru	1	0	0	1	0	3	<b>5</b>	
	Obuasi	1			2		1	4	
	Juaso	0	0	1	2	1	0	4	
	Assin Fosu	0	0	3	2	8	1	14	
	La	1	0	3	1	0	2	7	
	Ussher	0	0	2	1	0	4	7	
Subdistrict/Health Centre Labs	Tongo	0	0	0	1	0	0	1	<b>2</b>
	Jasikan	0	0	0	0	2	1	3	
	Asonomaso	0	0	1	2	0	0	3	
	Twifo Praso	0	0	0	1	2	0	3	
	Amasaman	0	0	1	0	0	1	2	
	Dodi Papase	0	0	2	1	0	0	3	
	New Abrim	0	0	0	1	0	0	1	
<b>Total Staff</b>		<b>26</b>	<b>13</b>	<b>35</b>	<b>47</b>	<b>34</b>	<b>65</b>	<b>220</b>	

# APPENDIX 8: VERONICA BUCKET





# APPENDIX 9: OTHER ISSUES AND SUGGESTIONS

At the request of USAID/Ghana, the DELIVER consultants and the Ghana team members did some investigations of the response to an avian flu epidemic. The following section briefly describes the Government of Ghana's response capability and some areas that need government attention in the event of an epidemic as well as the technical assistance needs related to supply chain management.

## **HEALTHCARE LOGISTICS AND PREPAREDNESS AND RESPONSE TO AVIAN FLU AND OTHER PUBLIC HEALTH EMERGENCIES**

The GOG and its development partners have developed a preparedness and response plan (PRP) to a potential outbreak or epidemic of avian flu. This plan is a comprehensive road map detailing preparations to protect the public in the event of an impending animal-human flu epidemic by outlining responsibilities for governmental, parastatal, community-based, and nongovernmental organizations. In addition, each region of the GHS has been tasked to prepare a regional plan for health care during a pandemic.

A plan of this complexity presents challenges when functions such as health care logistics are spread among many participants. The brief summarized below will examine the PRP from the perspective of coordinating logistical assets and needs among all these disparate groups. Commodities will be required in large numbers at short notice for surveillance, situation monitoring, assessment, and especially for containment.

### **CONTAINMENT AND HEALTH SYSTEM RESPONSE**

A major challenge is the nature of a pandemic involving both the animal and human environment. For example, the Ministries of Food and Agriculture; Land, Forestry, and Mines; and Health; the Veterinary Services and Wildlife Services; and the GHS all share responsibility for surveillance and assessment. A similar situation exists for prevention and containment with responsibility spread among seven agencies. Estimates of total deaths from a pandemic in Ghana vary from 20,000 to 120,000 if a case fatality rate of 0.6 percent is assumed. If rapid detection of a small number of cases occurs, the government's containment strategy could work if the needed supplies were immediately available. However, if containment fails, the consequences will be enormous.

### **FIRST STEPS**

If the government's schedule for rapid assessment of preparedness is completed on, or near, schedule in the spring of 2006, the next step would be a detailed quantification of the needed personal protective clothing, sample swabs and transport containers, decontamination equipment, and other supplies that would be needed for a typical containment response. This approach is in

full compliance with the key action of the PRP “prevention and containment of human populations and animal populations.”<sup>7</sup> After assessing the cost of the needed equipment and the current stocks at the various agencies and ministries, a funding gap analysis and procurement plan should be prepared. Next, a master plan for logistical support and coordination should be prepared for logistical support of actions sanctioned by the PRP.

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<sup>7</sup> This is a key action of the *Preparedness and Response Plan (PRP)* developed by the Republic of Ghana in December 2005.

# APPENDIX 10: PRINCIPAL CONTACTS

## **CENTRAL MOH/GHS**

Samuel Boateng, MOH/SSDM

Veronica Bekoe, GHS/PHRL

Rowland Adukpo, Korle-Bu Teaching Hospital Laboratory

Ekow Biney, Korle-Bu Teaching Hospital Laboratory

William Dei-Alorse, Korle-Bu Teaching Hospital Laboratory

## **ASHANTI REGION**

Festus Sroda, Public Health Laboratory, Kumasi

Asomaning, Kumasi South Hospital (Regional)

Kofi Baryeh, Kumasi South Hospital (Regional)

Asiedu Bekoe, Juaso Government Hospital

Elizabeth F. Buahing, Juaso Government Hospital

Lydia Obiyaa Arthur, Juaso Government Hospital

Joseph Owusu, Juaso Government Hospital

Alice Charwudzi, Obuasi Government Hospital

Kwaku Boateng Arthur, Asosnomanso Government Hospital

Samuel Ampadu Mireku, Asosnomanso Government Hospital

Sarfo Mensah, Asosnomanso Government Hospital

Patrick Mensah Derrick, Asosnomanso Government Hospital

Charlotte Hanson, Kumasi South Hospital (Regional)

## **CENTRAL REGION**

George Boakye, Twifo Praso Government Hospital

Charles Essoun, Twifo Praso Government Hospital

James Gawu, Twifo Praso Government Hospital

Issac Amankwa, Swedru Government Hospital

Sakyi Appiah, Swedru Government Hospital  
Bernadette Pufaa, Swedru Government Hospital  
Aaron Offei, Central Regional Health Directorate  
Charles Ampiah, Central Regional Hospital  
Kofi Osei, Central Regional Hospital  
Bortei, Central Regional Hospital  
Sister Isabella, Assin Foso District Hospital  
Mary Mensah, Assin Foso District Hospital  
Vida Hammond, Assin Foso District Hospital  
Mutsuko Okoshi, Assin Foso District Hospital

### **EASTERN REGION**

Francisca Dzata, Regional Hospital Laboratory, Koforidu, Eastern Region  
George Dankwa, Regional Hospital Laboratory, Koforidu, Eastern Region  
Stephen R.K. Ossom, Atua Government Hospital, Manya Krobo District  
Peter Owusu-Agyemang, Atua Government Hospital, Manya Krobo District  
Anita Ayo, NSawam Government Hospital, Akwapim South District  
William Ansah, New Abrim Health Centre, District of Birim North  
Emmanuel Andoh, New Abrim Health Centre, District of Birim North

### **VOLTA REGION**

Kwesi Asare-Bediako, Aflao District Hospital, Ketu District  
Simon Aglona, Aflao District Hospital, Ketu District  
Gayi Raymond, Jasikan District Hospital  
Edzi K. Andreas, Dodi Papase Mission Hospital, District Kadjebi  
Stannard I. Mahama Anabila, Dodi Papase Mission Hospital, District Kadjebi  
Lizz-Jane Amenyah, Dodi Papase Mission Hospital, District Kadjebi

### **UPPER EAST REGION**

Alhassan Batong, Bolgatanga Regional Hospital  
Daniel T.P. Anabah, Bawku Presbyterian Hospital  
Michael Mogre, Sandema District Hospital  
Raymond Bukari, Sandema District Hospital

Emmanuel Bewone, Tongo Health Center

### **NORTHERN REGION**

Joseph D. Laarie, Public Health Laboratory Tamale

Stephen Danuor, Public Health Laboratory Tamale

Alex Abaifaa, Salaga District Hospital

George Alhassan, Salaga District Hospital

Mahamadu Mumuni, Salaga District Hospital

George Obeng, Tamale Regional Hospital

Don Kwesi Emmanuel, West Gonja District Hospital

Samuel Akonnor, Yendi District Hospital

Iddrisu Salifu, Yendi District Hospital

### **GREATER ACCRA REGION**

Enoch Aninagyei, Amasaman Health Center

Dina Rabbles, La General Hospital

Geoffrey Atelu, La General Hospital

Tei Plehar, La General Hospital

Joyce Abbey, Ridge Hospital

Samuel Nordzi, Ridge Hospital

Lloyd Baffoe, Ussher Poly Clinic



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