



Improving the Referral System, Uganda

Strengthening the Capacity of the Regional Referral Hospitals

Version 2.0 | August 2019

Revision history

Revision number	Comments
1.8	January 2017
2.0	August 2019

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Executive Summary

Uganda has 14 Regional Referral Hospitals (RRHs) located at various districts throughout Uganda. The target population for each hospital is around two million people. Although the Regional Referral Hospitals continue to make a major contribution to the delivery of health services in Uganda, narratives about these institutions state that there are claims about a lack of adequate equipment, shortage of staff and substandard infrastructure, which mean that hospitals are unable to provide the volume or standards of care that their patients require.

A DRIVE project is in development entitled “Improving the Referral System in Uganda - Strengthening the Capacity of the Regional Referral Hospitals”. The overall aim of the project is to reduce mother and child morbidity and mortality rates as well as general morbidity and mortality rates in Uganda. This will be achieved by increasing the quality and quantity of healthcare services and by strengthening the Ugandan referral health care system at Regional level. This document outlines the proposed project definition, scope and expected results of the project, along with a detailed budget for each of the project elements.

Standard and Advanced equipment packages were developed for the Ugandan Regional Referral Hospitals. Three of the 14 hospitals were identified as requiring advanced package of equipment (Gulu, Mbale and Mbarara).

In March 2019, an up-to-date inventory was performed of all major equipment present at selected departments - maternity, newborn, diagnostic, A&E, intensive care and surgical - in all fourteen project hospitals. Equipment was

found to be in a poor state with gaps in the completeness of equipment packages.

Furthermore, whilst some equipment is available and functioning, this equipment is unlikely to remain functional for more than 2-3 years, due end of life or damage already done to components. It is recommended that existing equipment in each department is replaced when the DRIVE project is executed, with the exception of new equipment provided through other international aid projects such as the Japan International Cooperation Agency (JICA).

During each of the recent site visits, the infrastructure available to support the new equipment was assessed, both in terms of buildings and power supply. In order to generate enough power supply to support the new equipment, it is recommended that project hospitals receive upgrades to the switchgear, generators, transformers and voltage regulators. To house the new equipment and provide enough space for the (new) services to be provided safely and efficiently, additional departmental buildings have been incorporated into the project budget, alongside refurbishment works of existing buildings.

In order to optimise the outcomes of the project, maintenance services are included within the project for a total of five years. Furthermore, a capacity building programme for staff at all project sites will support the development of clinical skills, upgrade the nursing curricula at two nursing colleges and support the hospital maintenance teams.

The total cost of the project is budgeted at €55.240.437.

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List of Abbreviations

A&E	Accident and Emergency
CSSD	Central Sterile Supply Department
CT	Computed Tomography
DRIVE	Development Related Infrastructure Investment Vehicle
HC	Health Centre
HDU	High Dependency Unit
ICU	Intensive Care Unit
JICA	Japan International Cooperation Agency
MOH	Ministry of Health
NICU	Neonatal Intensive Care Unit
NMS	National Medical Store
NRH	National Referral Hospital
ODA	Official Development Assistance
OPD	Outpatient Department
OT	Operating Theatre
O2	Oxygen
RIS	Radiology Information System
ROI	Return On Investment
RRH	Regional Referral Hospital
RVO	Dutch Ministry of Foreign Affairs
PACS	Picture Archiving and Communication System
PS	Permanent Secretary
USAID	United States Agency for International Development
VHT	Village Health Team
WB	World Bank
WHO	World Health Organization

1 Introduction

1.1 Background

Although the Regional Referral Hospitals continue to make a major contribution to the delivery of health services in Uganda, narratives about these institutions state that there are claims about a lack of adequate equipment, shortage of staff and substandard infrastructure, which mean that hospitals are unable to provide the volume or standards of care that their patients require.

To that end, AMPC International Health Consultants has been assigned to perform an assessment of the 14 Regional Referral Hospitals in Uganda with the ambition to design a project eligible to bilateral Official Development Assistance (ODA) funding from the Netherlands. Such funding falls under the 'DRIVE' program (Development Related Infrastructure Investment Vehicle) from the RVO (Dutch Ministry of Foreign Affairs). The projected investment for the new project should make an optimal use of the existing budget within the Ministry of Health.

Since the inception of the project, several fact-finding missions have been conducted to assess the needs of the Regional Referral Hospitals and to define adequate solutions in order to meet the donor and client requirements. In order to ensure the project scope and budget are as up to date and accurate as possible before moving into the implementation stage of the project, the fourteen hospitals were re-visited in March 2019. This report, dated August 2019 (v 2.0) therefore replaces the last version (v 1.8) of this report, which was published in January 2017. It incorporates the findings of the most recent site visits, with the proposed solutions translated

into a final Project Definition ready for approval and execution.

1.2 Structure of the Report

This report consists of 3 chapters: following this introductory chapter, Chapter 2 describes briefly the methodology that was used to assess the 14 Regional Referral Hospitals (RRHs), followed by a summary of the overall findings at each of the departments assessed within the hospitals..

Chapter 3 focusses on the project definition, beginning with a description of the referral system in Uganda and the challenges it faces. The project scope section of this chapter also includes details of the proposed project equipment packages per department, an overview of the infrastructural upgrades required along with budget breakdowns for each of the project elements. This chapter includes objectives, expected results and risks of the project, and concludes with a project summary. The Annexes to this document include the latest site visit report, a detailed capacity building plan, equipment lists per hospital and the power infrastructural requirements.

2 Updated Findings

This chapter briefly describes the methodology that was used for the assessments of the 14 Regional Referral Hospitals (RRHs), followed by a summary of the overall findings at each of the departments assessed within the hospitals.

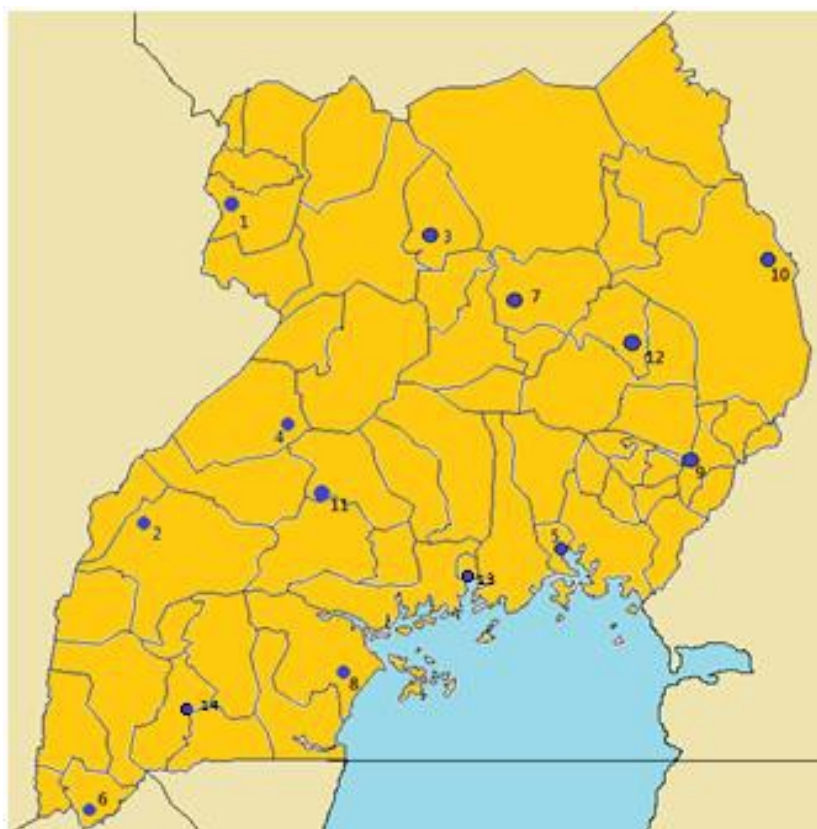
2.1 Methodology

Uganda has 14 Regional Referral Hospitals, and since it was expected that the status of the equipment, infrastructure and staffing in the hospitals would vary from hospital to hospital, all 14 hospitals were assessed individually. Since the hospitals are widely scattered throughout the country, three field trips were conducted to visit

all 14 hospitals. Figure 2.1 and Table 2.1 show the location, names and size of each of the project hospitals.

The main objective of the latest assessment visits was to collect up to date information that could be used to refine the scope of the project, aiming at strengthening the capacity of the Regional Referral Hospitals by means of providing equipment and infrastructural upgrades, as well as defining suitable training and maintenance packages needed to support this equipment.

Figure 2.1 Map of Uganda, showing locations of RRHs



Source: AMPC, 2019

Table 2.1 List of the Regional Referral Hospitals in Uganda

	Region	City	Hospital	No. of Beds
1	Northern Uganda	Arua	Arua Regional Referral Hospital	372*
2	Western Uganda	Fort Portal	Fort Portal Regional Referral Hospital	351*
3	Northern Uganda	Gulu	Gulu Regional Referral Hospital	300*
4	Western Uganda	Hoima	Hoima Regional Referral Hospital	280*
5	East Uganda	Jinja	Jinja Regional Referral Hospital	400*
6	South West Uganda	Kabale	Kabale Regional Referral Hospital	285*
7	Northern Uganda	Lira	Lira Regional Referral Hospital	256*
8	South Central Uganda	Masaka	Masaka Regional Referral Hospital	330*
9	Eastern Uganda	Mbale	Mbale Regional Referral Hospital	300*
10	North East Uganda	Moroto	Moroto Regional Referral Hospital	170*
11	Central Uganda	Mubende	Mubende Regional Referral Hospital	280*
12	East Uganda	Soroti	Soroti Regional Referral Hospital	270*
13	Central Uganda	Kampala	Naguru Regional Referral Hospital	100*
14	South West Uganda	Mbarara	Mbarara National Referral Hospital	600

Source: AMPC

* Actual number of beds as found during the assessment (most hospitals indicated that on top of the number of regular beds, there are many “floor” cases)

Data gathered through the assessment visits provided the following information:

- Information about the status of the major equipment located at the main departments in the 14 RRHs;
- Information about the infrastructure that supports this equipment;
- Information about the available Human Resources in the 14 RRHs;
- Mapping of the main challenges that the 14 RRHs are facing.
- Radiology (Imaging)
- Accident & Emergency (A&E)
- Main Operating Theatres (OTs)
 - CSSD (Sterilization)
 - Recovery
- ICU
- Maternity
 - Obstetric OTs/ Delivery Rooms
 - NICU
- Maintenance workshop

An inventory was done of all major equipment that were present during the time of the visits at selected departments. Neither instruments nor patient wards were part of the assessment. The following departments were included in this assessment:

In all Regional Referral Hospitals that were assessed outside the capital Kampala, the laboratories appeared to be in a rather good state. The number and type of equipment present as well as the maintenance status of the equipment were good. The reason for this is an ongoing countrywide project aiming at strengthening the capacity of the laboratories

funded by USAID/ Sustain¹. Since this project is still ongoing, it was decided to exclude the laboratories from the report.

2.2 Equipment Status

In all the hospitals assessed, in general equipment across all of the departments visited was in a “poor” status. This means that equipment was either partly broken (varying from a switch that is not working to an ultrasound transducer having problems with its crystals), or that the equipment was not working at all.

Furthermore, there is a gap in the “completeness” of equipment per department (e.g. a sufficient number of equipment and the most suitable type of equipment). However, whilst there is some equipment available and functioning it is recommended that all equipment in each department be replaced when this project is executed. The equipment currently in use is unlikely to remain functional for more than 2-3 years even if maintenance plans are put in place, due end of life or damage already done to components. The full site visit report is available as Annex I of this document.

In the next sections, a summary of the findings of equipment present at the various departments is described.

2.2.1 Imaging Department

All 14 Regional Referral Hospitals assessed had a functional radiology (imaging) department with generally the same equipment. Some departments are still using the equipment that was installed under a countrywide ORET project between 2004 and 2010. However, there were differences in the status of the equipment.

Common findings:

- In most hospitals there is a limited number of functioning x-ray equipment, e.g.

equipment that has no technical problems and is used by staff to its full potential;

- All facilities are still using analogue film processing and the few that did have a digital printer were struggling to obtain stock of film;
- In 2 hospitals the drying cabinet is not functional so the films were hung up to dry outside;
- Each hospital has one or two ultrasound scanners, varying in quality and age, but almost all had difficulties with probes and image quality with significant artefacts;
- Only Naguru RRH in Kampala and Mbarara NRH in South-West Uganda have a CT scanner; none of the other RRHs have a CT scanner;
- In none of the RRHs is an MRI scanner present;
- Only three RRHs have a mammography machine;
- Given the number of patients, diagnostic capacity of equipment is insufficient.

2.2.2 Main Operating Theatre

All hospitals assessed have one or more main Operating Theatre (OT). In most hospitals not all equipment was functioning well, and in some hospitals, equipment was old or partly broken. Especially OT lamps and OT tables were found to be in bad condition.

Common findings:

- OT lamps are almost always broken (bulbs faulty, expensive to purchase);
- OT tables are in bad shape;
- Anesthesia equipment is mostly insufficient and incomplete (e.g. monitors missing);
- Insufficient number of oxygen concentrators and suction pumps;
- Most hospitals have a separate obstetric OT, same “poor” status of these OTs.

¹ Only the laboratory at the RRH of Naguru in Kampala was not supported by USAID

The exception to the above are the OTs in the new buildings supported by the Japan International Cooperation Agency (JICA) in five of the RRHs. In these buildings the OTs were found to be equipped with functional equipment. In Moroto RRH the new building supported by the World Bank (WB) contained the main OT. In addition, the equipment at this OT was in better condition than equipment in the RRHs without a new building.

2.2.3 Central Sterilization Supply Department (CSSD)

The status of equipment at the CSSDs was found to be very poor in most hospitals.

Common findings:

- In most hospitals the status of sterilization equipment is very poor;
- Majority of autoclaves are faulty (due to power, usage of tap water);
- Often there is no real “central” sterilization department, but merely scattered through the hospitals;
- Hygiene in general is mostly suboptimal.

Exceptions to the above are the CSSDs in Soroti and Kabale. Soroti RRH had a well-equipped CSSD. This was due to a support project by the Korean government (Koica) that lasted until 2015. The CSSD in Kabale RRH is housed in a new building; the layout of this building was good as well as the equipment at the CSSD.

2.2.4 Recovery

Only Mubende RRH, Soroti RRH and Masaka RRH have a recovery room with four beds. However, no monitoring equipment was available in the recovery rooms. The other RRHs had either no recovery room at all, or only an empty room without any monitoring equipment or bed. In Kabale RRH a High Dependency Unit (HDU) was present, but this unit was not in use due to a shortage of trained staff.

2.2.5 NICU

Except for Arua RRH, all hospitals that were assessed had a NICU, however the status of the NICUs was not very good. Especially in Jinja RRH, Arua RRH and Moroto RRH the NICU was in need of almost all equipment. Due to the high fertility rate in Uganda, the maternity departments were extremely busy in all hospitals assessed. Hence, there is a high need for neonatal care. In most hospitals there is a need to upgrade the existing NICU facilities in order to provide better care for neonates.

Common findings:

- All maternity departments were oversubscribed;
- Status of equipment is poor: not enough incubators and/or broken incubators;
- Monitoring equipment is missing or broken;
- Phototherapy lamps and radiant heaters are insufficient in number;
- No functional NICU in some hospitals, but merely a medium care room.

2.2.6 Maternity/ Nursery

At the Maternity Departments the nursery rooms were found to be in a bad status: varying from no equipment, equipment in bad condition to “no nursery room” at all.

2.2.7 Obstetric OT

A dedicated Obstetric Operating Theatre was found in Fort Portal RRH and Hoima RRH. A second Obstetric OT was also present in Hoima, situated in the new JICA building. In Mbarara NRH one of the 4 OTs is used as a dedicated OT for Obstetrical and Gynecological patients. In Masaka RRH the obstetric OT will eventually be housed in a new maternity building, however construction of this building (which started in 2013) is stalled, due to cost overruns and financing issues. There is no clear timeline available when it will be finished. In general, the status of the Obstetric OTs was the same as the status of the main OTs: OT tables in bad condition and OT lamps broken.

2.2.8 ICU

The Intensive Care Units were among the clinical departments to be assessed by the AMPC team.

However, an ICU department was present in only 50% of the hospitals, and in 1 hospital a HDU unit was present.

Common findings:

- Intensive care services are very limited in the project hospitals;
- In the hospitals that had an ICU, there were some fully equipped ICU beds (e.g. complete with monitoring equipment and some ventilators);
- Some ICUs not in use due to the fact that no nursing staff are trained at the level of ICU nursing;
- Same observation for the HDU unit in Kabale RRH;
- No fully functional ICU or HDU department were observed in any of the Referral Hospitals.

2.2.9 Accident & Emergency (A&E)

The final clinical department assessed in each hospital was the A&E department. None of the hospitals had a well-equipped A&E department. In some hospitals an emergency department was present, but due to the absence of proper equipment and defibrillators it seemed to be almost impossible to deliver A&E services to the population. In most cases patients were sent to the wards directly.

Common findings:

- None of the hospitals had a well-equipped, fully functional A&E department;
- There is high demand for trauma and emergency services in Uganda;
- Only few of the hospitals have defibrillators in the emergency department;
- Most A&E departments have little to no monitoring equipment;
- In some hospitals a minor OT is linked to the A&E; but with no monitoring or other equipment (only OT tables in poor condition).

2.2.10 Maintenance Workshops

In each of the 14 Hospitals the maintenance capacity was assessed. The quality (availability of tools, spare parts and trained staff) and size of the workshops varied. However, workshops generally were extremely well equipped, well setup and spacious with excellent housekeeping and implementation of the “5 S” program.

While there were sufficient tools and the facilities to enable the local biomedical teams to carry out repairs, in many hospitals there was a stockpile of equipment awaiting spare parts. However, there seemed to be a general challenge with budget allocation for ordering of parts and breakdowns.

Where new equipment had been obtained over the last few years, it was evident that there was a lack of user training or training for the biomedical engineers for basic maintenance, which often resulted in the equipment either not being used at all or not being used correctly.

Furthermore it appeared that there were no maintenance contracts in place and consumables were not available. In almost all hospitals there was equipment in store rooms which was only missing a simple accessory or basic repair but due to improper handover of the equipment the local teams were not able to obtain the accessories or repair the equipment.

Common findings:

- Limited number of tools are present;
- Workshops seem to be well organized when engineer in charge is motivated, in other cases workshops were less organized ;
- Availability of spare parts is a huge challenge, especially for donated equipment and high-end equipment;
- There are regular stock-outs of consumables;
- Training level of technical staff and number of technical staff is mostly not sufficient;
- Some hospitals are using a truck to perform “maintenance outreaches” to the districts.

2.3 Infrastructure status

Over the last few years, there has been significant investment by the Japanese funding agency, Japan International Cooperation Agency (JICA), into the upgrading of various buildings at the regional referral hospitals. Where there has been JICA investment the buildings and infrastructure (power/water/medical gas) are in very good condition and of good quality.

However, the majority of buildings which have not been upgraded are in a very poor and dilapidated state and are in urgent need of highly needed renovations.

2.3.1 Power

A stable power supply is of critical importance at all hospitals. Almost all RRHs have a maximum available power supply of 200KVA with only Mabarara having three 500KVA transformers on site and a new main distribution panel. Where JICA have built new buildings/departments they have included a new transformer and distribution board for these buildings, but this does not extend to the rest of the hospital, nor does it have the capacity to be extended to other buildings on the site.

For any equipment upgrades to be successful upgraded power supplies will be required at each hospital including main switch gear, voltage regulators and stabilizers. Without this upgrade, any new equipment would not be able to function effectively. Electrical power quality is already significantly hindering the reliability and availability of much of the equipment currently present in the RRHs. For example, some CSSD departments have been upgraded recently with new vacuum steam sterilizers but are unable to run due to lack of power.

2.4 Human Resources Status

As in all other African countries, Uganda suffers from an overall shortage of health workers; in addition it was noticed that in the RRHs the

number of trained specialized nurses is not enough. This results in a significant challenge to provide A&E, ICU and NICU services.

Many hospitals have no ICU or even HDU department available at all and even in the few that had ICUs, most are not in use due to a lack of trained ICU nurses and other support staff. All hospitals expressed the need for a fully functional ICU, but confirmed that they did not have sufficient suitably trained staff to run the units. In many neonatal ICUs there are on average 10 - 15 babies per nurse at any given time, which significantly negatively influences the clinical outcomes and ability to deliver a full NICU service.

Surgeons were a contrast to this trend as there appeared to be sufficient surgeons available, however they were hindered by a lack of equipment with some hospitals even sending their surgeons to other hospitals as there were no longer the facilities available for them to continue performing procedures safely at the respective hospitals.

Furthermore, skilled technical staff needed to perform preventive and corrective maintenance of medical equipment are not present, either in number and/or level of training, in the assessed hospitals.

3 Project Definition

The overall project can be defined as the improvement of a selection of Uganda's hospital facilities (and thereby the referral health care system), through the delivery of a comprehensive package including infrastructural upgrades, delivery and installation of medical equipment, maintenance services and training to a total of 14 existing public Regional Referral Hospitals.

According to international OECD regulations, a project is defined as the smallest, complete productive entity, physically and technically integrated, that fully utilizes the proposed investment and captures all financial benefits that can be attributed to the investment.

According to this definition, each selected hospital can be identified as a productive integrated entity, which means that the overall project consists of 14 subprojects. The main focus of the project is on maternal and neonatal care, diagnostic services, emergency services and surgery services.

Within this section, the following aspects of the project definition are addressed:

- Project Scope;
 - Equipment;
 - Infrastructural works
 - Maintenance;
 - Capacity building.
- Objectives
- Expected Results
- Risks

3.1 Project Scope

The characteristics of the Ugandan healthcare system are briefly described below, including the

characteristics of the project hospitals (e.g. the Regional Referral Hospitals).

Public health services in Uganda are delivered through Health Centers (HC) II, HC III, HC IV, General Hospitals, Regional Referral Hospitals and National Referral Hospitals. The range of health services delivered varies with the level of care.

Health Centers

The HC I have no physical structure, but it consists of a team of people, the Village Health Team (VHT), which works as a link between the health facilities and the communities. The HC II provides only outpatient care and community outreach services. An enrolled comprehensive nurse is the key person between the VHTs and the HC IIs. The HC II provides the first level of interaction between the formal health sector and the communities. The HC III provides basic promotive, preventive and curative care and provides support supervision of the community and the HC IIs under its jurisdiction. There are provisions for laboratory services for diagnosis, maternal care and the HC forms the first referral point for the sub county.

General Hospitals

General hospitals are the first level of secondary care available and provide generalist hospital services to inpatients and outpatients. On average, a General Hospital has around 130 beds, a 24-hour emergency service and a minor operating theatre. In some circumstances primary health care services are rendered where there is no alternative source of this care within a reasonable distance. General hospitals receive

referrals from the dispensaries and health centers IV in its district.

Regional Referral Hospitals

Regional Referral Hospitals function as the first line of referral for the General Hospitals (or Health Centres IV if a general hospital is not available) and offer more advanced and relatively more specialized medical services than hospitals at general level. Since they cover a catchment area comprised of several districts, serving several millions of inhabitants, Regional Referral Hospitals are larger and employ more staff, including specialists in various fields, than general hospitals.

National Referral/ Specialized Hospitals

National Referral (specialized) Hospitals (NRHs) form the top of the referral system in Uganda. There are two National Referral Hospitals: Mbarara Hospital in the south and Mulago Hospital in the capital Kampala. These hospitals serve as the top referral centre for all Regional Referral Hospitals in the whole country. They offer tertiary services in various fields and specialties such as cardiology, oncology, neurology, paediatrics, nephrology and orthopaedics.

Table 3.1 summarizes the health service delivery system of Uganda.

Table 3.1 Summary health service delivery in Uganda

Level of Health Unit	Level	Target Pop	Services Provided
Health Centre I	Village	1.000	Community based Preventive and Promotive health services. Village Health committee
Health Centre II	Village	5.000	Preventive, Promotive and outpatient Curative health services. Outreach care and Emergency deliveries
Health Centre III	Village	20.000	Preventive, Promotive, Outpatient curative, Maternity, Inpatient health services and Laboratory
Health Centre IV	Health sub-district	100.000	Preventive, Promotive, Outpatient curative, Maternity, Inpatient health services, Emergency surgery and Blood transfusion, Laboratory services
General Hospital	Health sub-district	500.000	In addition to services offered at HC IV other general services are provided. It also provides in-service training, consultation and research to community-based health care programmes
Regional Referral Hospital	Health sub-district	2.000.000	In addition to services offered at the General Hospitals, specialist services are offered, such as Psychiatry, Ear Nose Throat, Ophthalmology, Dentistry, Radiology, Intensive Care, Pathology, Higher level surgery and medical services
National Referral Hospital	National		Provision of comprehensive specialist services. In addition they are involved in teaching and research

Source: AMPC, 2019

Table 3.2 Catchment population RRHs in Uganda

	Region	Town/ City	Hospital	Target Population	Referrals from
1	Northern Uganda	Arua	Arua RRH	3.600.000	8 districts
2	Western Uganda	Fort Portal	Fort Portal RRH	2.000.000	7 districts
3	Northern Uganda	Gulu	Gulu RRH	1.500.000	7 districts
4	Western Uganda	Hoima	Hoima RRH	2.000.000	7 districts
5	East Uganda	Jinja	Jinja RRH	2.000.000	N/A
6	South West Uganda	Kabale	Kabale RRH	1.500.000	N/A.
7	Northern Uganda	Lira	Lira RRH	3.250.000	8 districts
8	South Central Uganda	Masaka	Masaka RRH	2.000.000	N/A
9	Eastern Uganda	Mbale	Mbale RRH	2.500.000	14 districts
10	North East Uganda	Moroto	Moroto RRH	1.000.000	N/A
11	Central Uganda	Mubende	Mubende RRH	2.500.000	5 districts
12	East Uganda	Soroti	Soroti RRH	2.000.000	8 districts
13	Central Uganda	Kampala	Naguru RRH	120.000	N/A
14	South West Uganda	Mbarara	Mbarara RRH	3.000.000	N/A

Source: AMPC, 2019

All 14 Regional Referral Hospitals are part of the project. They are located at various districts throughout Uganda (see also the map in section 2.1). The target population for each hospital is around 2 million people and 7 or more districts refer their patients to these hospitals. There are some differences between the hospitals as captured in Table 3.2.

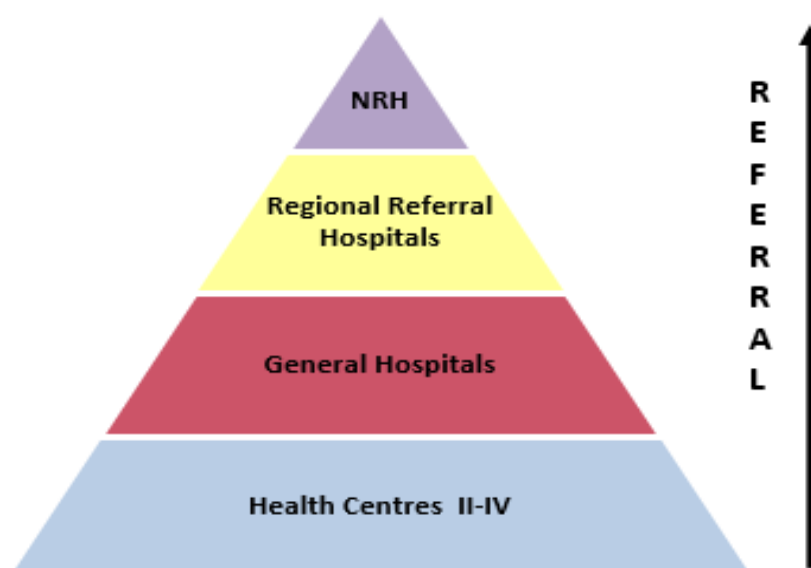
The Referral System

Referral can be defined as any process in which health care providers at lower levels of the health system, who lack the skills, the facilities, or both to manage a given clinical condition, seek the assistance of providers who are better equipped or specially trained, to take over responsibility for managing a clinical condition of a patient. Referral thus takes place from a lower level of care, to an increasingly higher level (see Figure 3.1). For a referral system to work, there should be a marked distinction in the type and level of services offered by healthcare facilities

at different levels. The referral system is consistent with the pyramidal shape of the healthcare system. The bottom represents many healthcare facilities at primary level who deliver basic healthcare services, from which a patient, if necessary, moves up along different levels of care to finally reach the top, which consists of a much smaller number of tertiary and specialized hospitals who have access to highly trained staff and the most advanced medical equipment.

A functional referral system corresponds to a geographical division where primary healthcare facilities in a certain district refer to the General Hospital. All General Hospitals in a certain region refer to the Regional Referral Hospital in that region. Regional Referral Hospitals in their turn refer to the National Referral Hospitals.

Figure 3.1 Referral System



Source: AMPC, 2019

Challenges for Uganda's Referral System

One of the main reasons for the referral system not to function properly is the (real or perceived) unavailability or inadequacy of services and resources (e.g. skilled staff and equipment) at lower levels of care which encourages patients to enter the health system at a higher level of care than strictly necessary. The Regional Referral Hospitals and National Referral Hospitals in Uganda are typical examples of this. This means that they are often overcrowded - delivering services to patients who could have been seen at a lower level- instead of being able to focus on more advanced (referral) services.

The Mulago Hospital in Kampala is the most used referral hospital.

The fact that the referral system is not working properly also leads to cost increases because many people are treated at a higher, costlier, level than necessary. One of the basic premises to strengthen the referral system, therefore, is to offer appropriate, high-quality care to patients at the lowest possible level to allow hospitals higher in the referral system to focus on more advanced services.

The second main reason is that many hospitals in Uganda are located in isolated regions, from where referral might exist as a theoretical concept, but is hardly a realistic option for patients who lack the financial means or time (in terms of progress in their medical condition) to travel to the nearest referral facility. For these hospitals it is even more important to be able to offer at least the range and quality of diagnostic and treatment services they are supposed to within the referral system. These hospitals should treat as many patients and conditions independently instead of having to advise them to seek for care at a more advanced and distant facility, knowing the patient is likely to go home and not receive any care at all. This project therefore focuses specifically on the Regional Referral Hospitals, providing access to well-functioning state-of-the-art medical equipment and trained staff, as it is expected that this will enable them to better fulfil their role in the referral system and ultimately improve patient care and health outcomes.

Strengthening the Referral System

Within the scope of the current project, the referral system is improved mainly in the areas of maternal and neonatal care, surgery, diagnostic imaging and emergency care. In practical terms this means, for example, that regional level maternity departments should be able to spend more time on high-risk pregnancies and deliveries with major complications. In the same way, better diagnostic imaging equipment installed in Regional Referral Hospitals (such as digital x-ray, PACS) will increase regional diagnostic capacity and relieve the pressure on the two National Referral Hospitals. To strengthen their position in the referral system even more, the Regional Referral Hospitals should be able to offer high-end diagnostic services like CT examinations, breast diagnosis and even MRI scans. Therefore, the diagnostics package of the project has been enhanced with high-end diagnostic imaging equipment such as CT scanners, Mammography equipment and MRI scanners.

3.1.1 Equipment

The supply of medical equipment is an integral part of the overall project and is based upon the actual needs of the 14 project hospitals. As explained in Chapter 2, site visits have been made to all project hospitals to assess the state of existing equipment. To decide upon the number and type of equipment to be installed in each hospital, the WHO standards and global best practices were studied. Also, the advice as formulated in a project meeting at the MOH in presence of the Permanent Secretary (PS), was used as an important determinant. Finally, the catchment population per hospital, and the outcome of the site surveys were taken into consideration as well as the needs expressed by clinical staff and the hospital management.

Based on above considerations AMPC defined a so called standard equipment package per department (with the exception of imaging, for which a Standard or Advanced equipment

package was defined). This was used to assess the completeness of equipment at each department. Each package specifies the optimum type of equipment as well as the ideal number that should be present of each equipment item. Equipment present at the RRHs was assessed against these benchmarks (please refer to Tables 3.3 – 3.9). Existing equipment was categorized as either “available” or “faulty”.

Overall, the project focuses on the upgrading of the equipment of the following departments and services:

- Maternity (Neonatal ICU, Labour suites, Nursery rooms, Obstetric Operating Theatres,);
- Operating Theatres (including Recovery rooms);
- Diagnostic Imaging (Ultrasound, X-Ray, CR, Mammography, CT, MRI);
- Sterilization (CCSD);
- Intensive Care (ICU) or High Dependency Care (HDU);
- Accident & Emergency.

Maternity

The improvement of maternal and newborn care is one of the main objectives of the project and will be reached through the equipping of Neonatal ICUs, labour rooms, nursery rooms and (obstetric) operating theatres. This equipment upgrade will allow the hospitals to deliver comprehensive delivery, emergency obstetric and newborn care. Items such as baby incubators, radiant infant heaters, phototherapy lamps, foetal monitors, baby cots, oxygen concentrators, pulse oximeters, neonatal reanimation tables operating tables and operating lamps are included in the equipment packages.

The ability to accurately diagnose diseases and monitor the effects of these treatments becomes increasingly important. Almost all project hospitals lack equipment for adequate diagnostic services.

Table 3.3 Equipment packages, Maternity / Newborn

	NICU	Nursery	Delivery Suite	Obstetric OT
Cot, baby	-	5	-	1
Radiant heater	-	2	-	1
Phototherapy lamp	2	1	-	-
Incubator	4	-	-	-
Open incubator/heater/phototherapy lamp	4	-	-	-
Patient monitor	8	-	-	1
Ventilator, baby	4	-	-	-
Oxygen concentrator	4	2	2	1
Suction pump	2	1	2	1
Scale, baby	1	1	2	1
Delivery bed	-	-	5	-
CTG machine	-	-	2	1
Examination lamp	-	-	2	-
Pulse oximeter	-	5	2	-
Resuscitation table	-	-	1	1
Autoclave	-	-	1	-
Operating table	-	-	-	1
Operating lamp, ceiling mounted	-	-	-	2
Operating lamp, mobile	-	-	-	1
Electrosurgical machine	-	-	-	1
Anaesthesia machine	-	-	-	1
Defibrillator	-	-	-	1

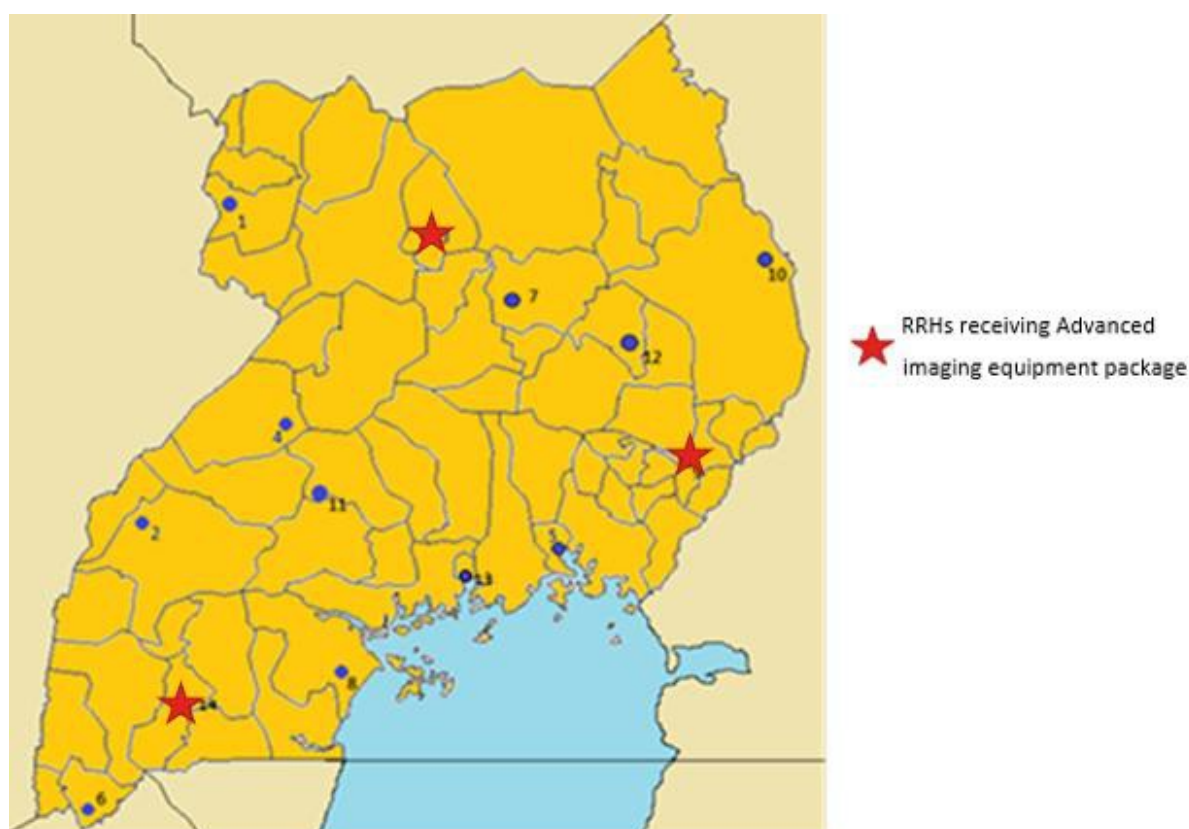
Source: AMPC, 2019

Imaging

According to their classification within the referral system, Regional Referral Hospitals require a fully functional radiology department: x-ray unit (for extremities, chest and emergencies) as well as one or more ultrasound units (mainly for obstetric purposes). In all of the

referral hospitals, high-end diagnostic equipment will be installed according to their specific needs. All RRHs will receive a CT scanner. Additional to this, an Advanced imaging equipment package including an MRI-scanner is foreseen for three hospitals – Gulu RRH, Mbale RRH and Mbarara NRH, since these hospitals are

Figure 3.2 Location of Gulu, Mbale and Mbarara RRHs



Source: AMPC, Aug 2019

connected to (Medical) Universities and serve large catchment areas in the country. They are also geographically well-spaced throughout Uganda, thus minimizing travel distances for

patients requiring these specialist services (see Figure 3.2).

Table 3.4 below lists the equipment packages for diagnostic imaging departments.

Table 3.4 Equipment packages, Imaging

Equipment	Standard*	Advanced*
Ultrasound unit	2	2
X-ray unit, mobile	1	1
X-ray unit, Bucky table, digital	1	1
X-ray unit, mammography, digital	1	1
Printer, Dicom	1	2
PACS system, compact, with work station	1	-
PACS system, large, with work station	-	1
CT scanner, 64 slice	1	1
MRI 1,5 Tesla	-	1

Source: AMPC

*Advanced Packages are required at 3 hospitals (Gulu, Mbale, Mbarara); the other 11 RRHs require Standard Packages

Following the latest developments, and thus encouraging e-health, all analogue diagnostic machines will be provided with a digital reader (CR)-package. This technology is a proven technology with many advantages. First of all, this implies that x-ray pictures, including ultrasound, will be digital, and can thus be stored digitally as well as sent by e-mail if necessary. Old-fashioned chemical developing methods will be replaced by this new technology, not only reducing processing time as well as reducing the negative impact on the environment. The numbers of fault pictures will be reduced significantly since digital pictures can be viewed directly on a screen, and retaken if necessary.

Furthermore, a Picture Archiving and Communications System (PACS) and a Radiology Information System (RIS) will be installed at each hospital. A PACS allows hospitals to capture, store, view and share all images that are produced by the imaging equipment. RIS complements the PACS system. It is expected that the use of PACS will have a positive effect on the workflow efficiency in the 14 Hospitals.

To enhance the functionality of PACS even more, a central PACS coordination unit will be installed in Kampala, where the largest number of Ugandan Radiologists are stationed. The central PACS unit enables radiographers and other health staff in the 14 RRHs to consult radiologists in Kampala by saving the pictures of examinations in the PACS cloud. This will enable staff to write reliable reports on CT and MRI examinations as well as on complex cases captured on ultrasound scans and x-ray pictures. Additional to this, supervision from central level in Kampala to the Referral hospitals becomes easy, since communication about pictures captured on complex cases or general cases can be done online via the PACS system. Retrieving images for teaching purposes is another functionality of PACS, which can be used to

upgrade the knowledge of existing radiographers and other imaging technicians in Uganda.

A PACS has four major components (hardware and software):

- Imaging systems (e.g. CT, ultrasound, x-ray);
- A secure network for distribution and exchange of patient information;
- Workstations or mobile devices for viewing, processing and interpreting images;
- Archives for storage and retrieval of images and related documentation and reports.

Operating Theatres

To enhance the surgical capacity of the Regional Referral Hospitals in each existing Operating Theatre equipment will be either replaced, renewed or added. Each OT will be upgraded receiving equipment such as operating tables, operating lamps (ceiling mounted or mobile), anesthesia machines, O2 concentrators, monitoring equipment, electro-surgical equipment and defibrillators. Table 3.5 below lists the equipment package for each OT.

Table 3.5 Equipment package, OT

Equipment	Per OT room
Operating table	1
Operating lamp, ceiling mounted	2
Operating lamp, mobile	1
Electro surgical machine	1
Anaesthesia machine	1
Patient monitor	1
Defibrillator	1
Suction pump	1
Oxygen concentrator	1

Source: AMPC, 2019

CSSD

Ensuring that medical instruments are sterile is crucial to the safety of patients. In almost all hospitals the sterilization procedures were found to be inadequate. One or more autoclaves together with a water treatment system will be installed. Sterilization will be improved at all hospitals altogether. The equipment supplies for Soroti RRH, where the CSSD department had been supported by a project (that ended in 2015) funded by the Korean government will be adapted to suit the level of the need in this hospital. Table 3.6 lists the equipment package for each CSSD.

Table 3.6 Equipment package, CSSD

Equipment	Per CSSD
Autoclave	1
Autoclave (table top)	1
Water treatment	1

Source: AMPC, 2019

Recovery

A recovery room should be present and well equipped at each main OT as well as at the obstetric operating theatres. In only a few RRHs a recovery room or area was present. These RRHs will receive the monitoring equipment needed to run a recovery room. RRHs that completely lack a recovery room will receive recovery beds, monitoring equipment, O₂ concentrators and mobile lamps. Table 3.7 lists the equipment package for each recovery.

Table 3.7 Equipment package, Recovery

Equipment	Per Recovery
Recovery bed	2
Patient monitor	2
Lamp, mobile	1
Oxygen concentrator	1

Source: AMPC, 2019

ICU

Given their crucial position in the referral system, each Regional Referral Hospital is required to provide Intensive Care of High Dependency Care. In RRHs where there is not yet an ICU, a full intensive care unit or high dependency unit will be erected. Equipment items that will be provided are patient beds, ventilators, monitoring equipment, suction pumps, oxygen concentrators and mobile lamps. It is foreseen that 7 RRHs will receive an ICU and the other 7 RRHs will receive a HDU unit. The equipment for each ICU or HDU is shown in Table 3.8.

Table 3.8 Equipment package, ICU/HDU

Equipment	Per ICU or HDU
Patient bed	6
Patient monitor	6
Central monitoring post	1
Lamp, mobile	3
Patient ventilator	3
Suction pump	3
Infusion pump	6
Oxygen concentrator	3
Defibrillator	1
Blood gas analyser	1
Haemoglobin meter	1
Electrolyte analyser	1
Lab Refrigerator	1
Lab Freezer	1
Centrifuge	1

Source: AMPC, 2019

A&E

Comprehensive care to be delivered at the Regional Hospitals comprises casualty care. The number of road accidents and other emergencies continues to increase, therefore the need to treat casualty victims in the various

districts of Uganda is high. Referral to Kampala takes long and the quality of the roads is not always convenient for casualty patients that need to be transported. A well-equipped casualty department is needed at each of the 13 RRHs. Equipment items to be provided are patient- and examination beds, monitoring equipment, defibrillators, OT lamps, suction pumps, autoclaves and oxygen concentrators. The equipment package for an A&E department is listed in Table 3.9.

Table 3.9 Equipment package, A&E

Equipment	Per A&E/ Casualty
Patient beds	10
Examination bed	2
Treatment table	1
Treatment lamp, mobile	1
Suction pump	2
Oxygen concentrator	2
Defibrillator	1
Autoclave	1
Humidifier	1
Patient monitor	2

Source: AMPC, 2019

completed at the project hospitals, for example, JCIA projects at Arua, Gulu and Lira RRHs. The equipment package at these hospitals will therefore be adjusted as needed to ensure a standard/advanced package is realized at all 14 RRHs, without duplication of equipment between projects. Care has been taken to ensure this DRIVE project is complementary to ongoing or recently completed international aid programs, hence a tailor-made equipment and infrastructural program has been developed for each project hospital.

The total value of the equipment to be supplied is EUR 33.886.140. An overview of the investment per hospital can be found Table 3.10. Please refer to Annex II for a full breakdown of proposed equipment per department for each Regional Referral Hospital.

Total equipment budget

For each hospital, an assessment was made as to which equipment packages should be included within this project. In the case of imaging, a Standard or Advanced was selected (see Table 3.4), the major difference being the addition of an MRI scanner in the Advanced package. Three hospitals – Gulu, Mbale and Mbarara – were selected to receive the Advanced-imaging package due to their geographical location and position in the Ugandan referral network.

It should also be noted that there are a number of other projects either underway or recently

Table 3.10 Summary of equipment budget per hospital

	A&E (10 Bed)	X-Ray & US	Mammo	CT - 64 slice	MRI 1.5T	PACS	OT (2)	ICU (6 Bed)	NICU (8 Bed)	Maternity	CSSD	Total Equipment Cost Per Hospital
Arua	17.513	38.000	173.000	475.000		85.000	136.862	269.053	350.000	128.000	60.000	1.732.428
Fort Portal	190.000	298.000	173.000	475.000		85.000	307.000	310.000	350.000	128.000	95.000	2.411.000
Gulu	17.513	38.000	173.000	475.000	1.150.000	85.000	98.996	223.668	182.427	86.680	60.000	2.590.284
Hoima	190.000	298.000	173.000	475.000		85.000	307.000	310.000	350.000	128.000	35.000	2.351.000
Jinja	190.000	298.000	173.000	475.000		85.000	307.000	85.000	350.000	128.000	95.000	2.186.000
Kabale	190.000	298.000	173.000	475.000		85.000	263.000	310.000	350.000	128.000	18.000	2.290.000
Lira	17.513	38.000	173.000	475.000		85.000	155.862	269.053	350.000	128.000	35.000	1.726.428
Masaka	190.000	298.000	173.000	475.000		85.000	282.000	310.000	350.000	128.000	55.000	2.346.000
Mbale	190.000	298.000	173.000	475.000	1.150.000	85.000	307.000	310.000	350.000	128.000	95.000	3.561.000
Mbarara	190.000	298.000	173.000	475.000	1.150.000	85.000	263.000	85.000	350.000	128.000	95.000	3.292.000
Moroto	190.000	298.000	173.000	475.000		85.000	307.000	310.000	350.000	128.000	55.000	2.371.000
Mubende	90.000	298.000	173.000	475.000		85.000	263.000	310.000	350.000	128.000	35.000	2.207.000
Naguru	190.000	298.000	173.000	475.000		85.000	307.000	310.000	350.000	128.000	95.000	2.411.000
Soroti	190.000	298.000	173.000	475.000		85.000	307.000	310.000	350.000	128.000	95.000	2.411.000
Total (Euro)	2.042.539	3.392.000	2.422.000	6.650.000	3.450.000	1.190.000	3.611.720	3.721.774	4.732.427	1.750.680	923.000	33.886.140

3.1.2 Infrastructural Works

Construction and refurbishment

To secure the proper functioning of the new high-end medical imaging equipment, pre- installation works, room adaptations and a range of minor-to-major rehabilitation works to the radiology departments are incorporated as part of the overall project. The proposed renovation works have the objective of improving the functionality of the radiology departments where high-end equipment will be installed.

In addition, considering the age of the buildings and layout, it is advisable to include rebuild of selected departments as part of this project.

Renovation of these departments would be difficult and an unwise investment. In other cases, for example, the installation of an MRI scanner, construction of a new building will be necessary; partly because there is no spare capacity in existing buildings and partly because such valuable and sensitive equipment must be housed appropriately to ensure its protection and optimum lifespan.

Each referral hospital will receive new mammography and CT equipment. The existing radiology department buildings are too small to house this equipment, therefore new buildings will be constructed to house this equipment.

In hospitals that do not yet have an ICU department, pre-installation works, room adaptations, minor rehabilitations or even construction of a complete new department are included.

The infrastructural work required varies per hospital with a range of four to nine departments affected. Table 3.11 gives an idea of the scale of the work by showing the number of hospitals grouped into different volumes of infrastructural work, with an average budget per group. In terms of the location of the work - all hospitals require infrastructural upgrades to support functional radiology, ICU and/or NICU services. 10 hospitals will benefit from infrastructural upgrades to support maternity services, 6 hospitals for OT, and 5 hospitals for A&E.

Power infrastructure requirements

Furthermore, the necessary infrastructure work and equipment associated with upgrading the electrical capacity of the relevant hospital departments is included as part of this project element. This is seen as essential facilitatory work to enable the equipment purchased as part of the project to be utilized. Eight hospitals will require a full upgrade of transformer, voltage regulator and switchgear, five will need a partial upgrade of one or two of these elements, and one does not need any power upgrade.

Table 3.11 Overview of infrastructural works (construction, refurb and extension)

No of departments requiring infrastructural works	No. of hospitals	Average infrastructural budget
Four departments	2	€330.513
Five departments	5	€442.588
Six departments	2	€528.730
Seven departments	0	n/a
Eight departments	4	€648.143
Nine departments	1	€725.394
TOTAL	14	€517.814

Source: AMPC, 2019

Total Infrastructure budget

The budget for infrastructural works per hospital can be found in Table 3.12. This estimation is based on local prices, derived from comparable projects in Uganda, and an estimation of square metres based on international guidelines.

Different prices per square meters were used according to whether the infrastructural work related to new build, extending existing buildings, or refurbishment (major / minor). Some materials and installations will need to be imported, such as lead shielding and specific electricity cables. However, the budget assumes that the works will be executed by local contractors and craftsmen. The total budget for the execution of infrastructural works during the implementation phase is EUR 7.192.716.

Key:

- New Build
- Extension
- Major refurb
- Minor refurb

Table 3.12 Infrastructure budgets per hospital

	Infrastructural works per department									Power upgrade to support new equip	Contingency	TOTAL
	A&E	X-Ray & US	Mammo	CT	MRI	OT	ICU	NICU	Maternity			
Arua			16.020	60.075			63.830	80.100	108.135	101.752	42.991	472.904
Fort Portal	53.191	66.083	16.020	60.075		63.830	120.150	42.553	57.447	141.802	62.115	683.267
Gulu			3.200	12.000	12.000		63.830			141.802	28.436	256.115
Hoima		66.083	16.020	60.075			63.830	42.553	57.447	141.802	44.781	492.591
Jinja	53.191	66.083	16.020	60.075		63.830	63.830	80.100	57.447	141.802	60.238	662.616
Kabale		66.083	16.020	60.075			78.849	52.566		101.126	37.472	412.190
Lira			16.020	60.075			63.830	80.100	108.135	141.802	46.996	516.959
Masaka		66.083	16.020	60.075			78.849	42.553	108.135	141.802	51.352	564.869
Mbale	100.125	66.083	16.020	60.075	72.090	63.830	120.150	42.553	57.447	61.076	65.945	725.394
Mbarara			8.511	31.915	38.298			42.553	108.135	61.076	29.049	319.537
Moroto			3.200	12.000		120.150	120.150			61.076	31.658	348.234
Mubende		66.083	16.020	60.075			120.150	42.553		141.802	44.668	491.352
Naguru	53.191	35.106	8.511	31.915		63.830	78.849	42.553	57.447		37.140	408.542
Soroti	100.125	66.083	16.020	60.075		120.150	120.150	80.100	57.447	141.802	76.195	838.148
TOTAL												7.192.716

Source: AMPC, August 2019

3.1.3 Maintenance

The site surveys indicated that appropriate maintenance of the Medical Equipment is of utmost importance to ensure sustainability of the project, in combination with providing the existing Biomedical Workshops at the Hospital with up to date skills and appropriate tools.

The project includes full comprehensive maintenance services for the installed medical equipment during a period of five years (1-year warranty and 4 years after installation). Maintenance services will consist of minimum two preventive maintenance cycles per hospital per year, or more frequent if the OEM suppliers prescribe this (e.g. for CT and MRI). During preventive maintenance rounds, all equipment will be fully checked on functionality, calibrated and if necessary, spare parts will be provided and placed to ensure correct functioning of the equipment. In addition, corrective maintenance activities, in case of malfunction of the equipment, will be carried out. All required labor and parts are covered in the Budget. The aim for this Maintenance Program is to ensure a minimum of 92 – 95 % uptime country wide for all equipment. The total budget for the four-year maintenance period is EUR 9.475.581.

Table 3.13 Maintenance budgets per hospital

	Total Equipment Cost Per Hospital	First year covered by equipment warranty	Year 1 Maintenance Budget	Year 2 Maintenance Budget	Year 3 Maintenance Budget	Year 4 Maintenance Budget	Total Maintenance Budget
Arua	1.732.428	0	117.613	117.613	117.613	117.613	470.452
Fort Portal	2.411.000	0	159.595	159.595	159.595	159.595	638.380
Gulu	2.590.284	0	213.384	213.384	213.384	213.384	853.536
Hoima	2.351.000	0	155.695	155.695	155.695	155.695	622.780
Jinja	2.186.000	0	144.970	144.970	144.970	144.970	579.880
Kabale	2.290.000	0	151.950	151.950	151.950	151.950	607.800
Lira	1.726.428	0	117.128	117.128	117.128	117.128	468.512
Masaka	2.346.000	0	155.495	155.495	155.495	155.495	621.980
Mbale	3.561.000	0	272.295	272.295	272.295	272.295	1.089.180
Mbarara	3.292.000	0	255.030	255.030	255.030	255.030	1.020.120
Moroto	2.371.000	0	156.995	156.995	156.995	156.995	627.980
Mubende	2.207.000	0	149.555	149.555	149.555	149.555	598.220
Naguru	2.411.000	0	159.595	159.595	159.595	159.595	638.380
Soroti	2.411.000	0	159.595	159.595	159.595	159.595	638.380
TOTAL	33.886.140	0	2.368.895	2.368.895	2.368.895	2.368.895	9.475.581

3.1.4 Capacity Building

Capacity building is an important element of the project, aiming at improving Uganda's hospital facilities, and thereby the referral health care system. Besides the delivery and installation of medical equipment and maintenance services to 14 public hospitals, training and related capacity building activities will ensure the effectiveness and sustainability of the project. Within the scope of the overall project, the capacity building program has the following objectives:

1. To ensure effective clinical use of the equipment installed;
2. To ensure a continuous supply of trained specialized nursing staff;
3. To ensure sustainability of the investment by improving maintenance capacity.

To this end, the capacity-building program will focus on four main areas:

1. Buttonology/ application training
2. Clinical skills (short-term)
3. Clinical skills (long-term)
4. Maintenance skills & workshop upgrades

Buttonology/ application is a service that is included in the services of installing and commissioning of the medical equipment. Therefore, this will be provided by the contractor who is responsible for the supply and installation of each piece of equipment.

Under the short-term clinical skills program, 12 different training courses, including a Train the Trainer approach, will be organized for different target groups such as clinical skills training in specialized nursing for midwives, nurses and OT-nurses, NICU nursing, ICU nursing, A&E nursing and OT nursing. Clinical skills training for radiographers and radiologists on CT, MRI and mammography.

With the long-term clinical skills package the curriculum of local Nursing Colleges will be upgraded, skills labs at these colleges will be set-up and exchange programs for Ugandan health staff to Universities abroad will be implemented.

The maintenance part of the capacity-building program consists of training technical staff based at the referral hospitals in the skills to maintain the equipment that will be installed under the project. Furthermore, the maintenance workshops at the referral hospitals will be strengthened with basic tools and equipment for repair as well as calibration equipment.

The total budget for capacity building is EUR 4.686.000.

Please refer to the Capacity Building Plan in Annex III for the detailed description of the programs.

3.2 Objectives of the Project

The overall goal of the project is to reduce mother and child morbidity and mortality rates as well as general morbidity and mortality rates in Uganda. This will be achieved by increasing the quality and quantity of healthcare services and by strengthening the Ugandan referral health care system at Regional level. In the following logical framework of Table 3.14, the objectives and activities of the project are depicted.

Table 3.14 Logical Framework

Goals	Objectives	Programmes	Activities	Verification
To reduce mother and child mortality and morbidity rates in Uganda	To improve the quality of medical services in Uganda, specifically diagnostic imaging services, surgical services, emergency services and maternity care	Infrastructure upgrading or constructing new buildings in 14 hospitals	Review of the functional plan of each hospital; Implementation of infrastructural works	Site-readiness assessment
To reduce general mortality and morbidity rates in Uganda		Procurement and installation of medical equipment and furniture in 14 hospitals	Procurement; Installation; Testing; User training	BoQ and Purchase documents Trained users
			Preparation of tender documents	Quality of response to the tender
		Establishment of a maintenance program for medical equipment in 14 hospitals	Training; Maintenance services	Equipment operational Down-time minimized Maintenance department trained
	To improve the quality of medical services in Ugandan Referral hospitals	Educational program to ensure effective use of newly installed medical equipment	Buttonology training	Trained staff Equipment operational in all hospitals
		Maintenance management	Maintenance workshop outfitting; Maintenance management training	Operational Maintenance Management System RRs; Trained staff
		Clinical skills training	Clinical skills training specialized nursing; Training radiographers and radiologists;	Trained clinical nursing staff Trained midwives Trained radiographers Trained radiologists
To ensure sustainability of health service delivery	To ensure continuous availability of trained specialized staff	Upgrading the curricula of nursing programs at 2 local schools of nursing Short courses in specialized medical imaging (CT, MRI, Mammography, Ultrasound)	Train the Trainers Skills lab implementation	Trained trainers Improved curricula Skills labs with mannequins

Source: AMPC, August 2019

3.3 Expected Results of the Project

The expected outputs per project component include the following:

Equipment delivery and installation

- Improved diagnostic facilities at 14 hospitals by means of the installation of 25 ultrasound scanners, 11 digital mobile x-ray units, 11 digital x-ray units with a Bucky table, 14 PACS systems, 14 digital Mammography units, 14 CT scanners and 3 MRI scanners;
- Improved obstetric care facilities at 14 hospitals;
- Improved neonatal care facilities at 14 hospitals;
- Improved surgical care and sterilization facilities at 14 hospitals;
- Improved intensive care facilities at 14 hospitals;
- Improved emergency care facilities at 14 hospitals.

Infrastructural works

- Infrastructural works (new build/extensions/renovations) at 14 hospitals;
- Infrastructure of the power supply to support the new equipment at 13 hospitals;

Maintenance

- Maintenance services provided to 14 hospitals for a period of 5 years post-equipment delivery.

Capacity Building

- Staff trained how to use new project equipment;
- Up to 629 staff trained in project-related clinical skills (e.g. A&E, ICU, radiology, OT, obstetrics);
- Nursing curricula upgrades and new skills labs at two Ugandan nursing colleges, plus an international ICU and NICU clinical exchange program;

- 26 maintenance staff trained in technical skills plus 8 biomedical engineers trained at an international CT and MRI maintenance course.

3.4 Risks

The possible risks of the project in the Implementation phase and in the Operation & Maintenance phase, as well as the mitigation measures for each identified risk aspect are summarized in Table 3.15.

Table 3.15 Potential risks during Implementation and Operation and Maintenance phases

Type of risk	Description	Chance of risk	Impact	Mitigation
Implementation Phase				
Financial	Own contribution not available	Medium	Delay of project	The Ministry of Health has guaranteed budget allocation for its own contribution; Exact budget allocation is being secured within the Medium-Term Expenditure Framework.
Organizational	Delays in tender procedure and contracting	Medium	Delay of project start	Preparation of tender documents by experienced consultants is included in development phase
Technical	Lack of technical skills in country to implement the project	Low	Delay of project	One of the outputs of the development phase are detailed technical tender specification; The contractor responsible for the implementation will need to show a successful track record in similar projects
Operation and Maintenance Phase				
Organizational	Hospital staff is not sufficiently qualified to operate new medical equipment	Medium	Delay in exploitation and/or poor performance	Buttonology training is included in the institutional strengthening program; Technology to be implemented through the project will be context appropriate.
Organizational	Management is not sufficiently competent	Medium	Delay in exploitation and/or poor performance	Hospital management and maintenance management are included in the institutional strengthening program
Financial	Inability of capturing user fees	Low	Operational deficits	The need for high quality medical services and related purchasing power are present; All services carried out will have to be paid prior to the patient's treatment
Financial	Insufficient funds to cover operational costs	Medium	Hospital not fully operational	Guarantee of MOH to cover operational deficits
Financial	Insufficient funds exist for equipment maintenance	Medium	Equipment not adequately working	Equipment maintenance is included in the project

Source: AMPC, August 2019

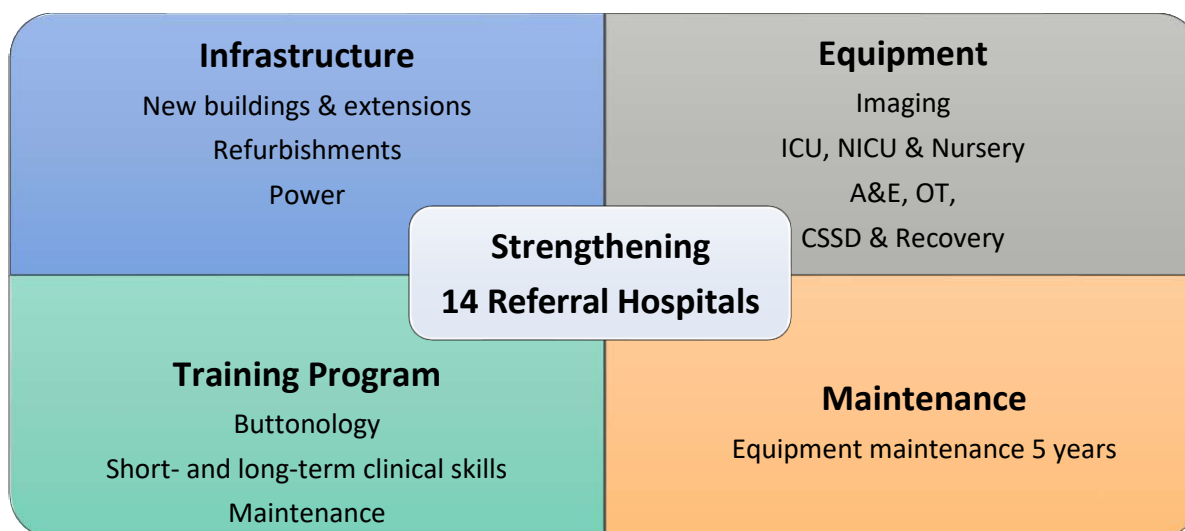
3.5 Summary

The Project can be considered to consist of four elements, as illustrated in Figure 3.3.

Maintenance

All equipment installed will be maintained during a period of 5 years (1 year of warranty plus 4 years of maintenance cover).

Figure 3.3 Project elements



Source: AMPC, August 2019

Delivery and installation of medical equipment

In all 14 project hospitals the quality and quantity of medical equipment will be improved for Obstetric and Neonatal care, Diagnostic imaging, OT/ sterilization, ICU and Emergency care.

Improvement of physical infrastructure

To ensure proper functioning of the new high-end Diagnostic Medical Equipment, pre-installation works, room adaptations and rehabilitation works will be carried out in all 14 hospitals. Extensions or new buildings will be constructed to house the new mammography, CT and MRI scanners. All hospitals require infrastructural upgrades to support functional ICU and/or NICU services. 10 hospitals will benefit from infrastructural upgrades to support maternity services, 6 hospitals for OT, 5 hospitals for A&E. All but one hospital will receive an upgrade to their power supplies.

Capacity Building

Capacity building and transfer of the specific knowledge and skills throughout the Ugandan healthcare system will ensure the sustainability of the project. The capacity building program consists of the following components:

1. Buttonology/ Application training
2. Clinical skills (short-term)
3. Clinical skills (long-term)
4. Maintenance skills & workshop upgrades

The project will be implemented in existing hospitals that are currently operational. This means that buildings and utilities are available, as well as human resources and budgets for consumables and other operational costs. The continuation of these project elements is guaranteed by the MOH and no DRIVE financing is requested for these.

A breakdown of the projected total project costs is presented in Table 3.16.

Table 3.16 Total projected project costs

	Equipment	Infrastructure	Capacity Building	Maintenance	Total Investment
Arua	1.732.428	472.904	321.000	470.452	2.996.784
Fort Portal	2.411.000	683.267	321.000	638.380	4.053.647
Gulu	2.590.284	256.115	385.000	853.536	4.084.935
Hoima	2.351.000	492.591	321.000	622.780	3.787.371
Jinja	2.186.000	662.616	321.000	579.880	3.749.496
Kabale	2.290.000	412.190	321.000	607.800	3.630.990
Lira	1.726.428	516.959	321.000	468.512	3.032.899
Masaka	2.346.000	564.869	321.000	621.980	3.853.849
Mbale	3.561.000	725.394	385.000	1.089.180	5.760.574
Mbarara	3.292.000	319.537	385.000	1.020.120	5.016.657
Moroto	2.371.000	348.234	321.000	627.980	3.668.214
Mubende	2.207.000	491.352	321.000	598.220	3.617.572
Naguru	2.411.000	408.542	321.000	638.380	3.778.922
Soroti	2.411.000	838.148	321.000	638.380	4.208.528
EURO	33.886.140	7.192.716	4.686.000	9.475.581	55.240.437

Source: AMPC, August 2019

Annexes

Annex I Site Visit Report

Annex II Equipment List per Hospital

Annex III Capacity Building Plan

Annex IV Power Infrastructure Requirements

Annex I

Site Visit Report

April 2019

Annex II

Equipment List per Hospital August 2019

Annex III

Capacity Building Plan August 2019

Annex IV

Power Infrastructure Requirements March 2019

