

The Government of Uganda

Ministry of Health



Strengthening Paediatric Surgical Services in Uganda 2023 - 2027

Final Report and Implementation Plan



Mulago National Referral Hospital, Uganda

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ABBREVIATIONS

NSOAP	National Surgical Obstetric and Anaesthesia Plan
LCoGS	The Lancet Commission on Global Surgery
PS	Permanent Secretary of Health, Uganda
UHC	Universal Health Coverage
LMIC	Low- and middle-income country
HIC	High income country
WHO	World Health Organization
WHA	World Health Assembly
DCP	Disease Control Priorities
RRH	Regional Referral Hospital
GH	General Hospital
UCSF	University of California San Francisco

EXECUTIVE SUMMARY OF THE REPORT

In August 2022 the Permanent Secretary of The Ministry of Health for Uganda called for a Taskforce to convene to develop a plan to scale up access to safe, affordable and timely surgery for children.

With just seven practicing paediatric surgeons and an estimated need for at least 210, the scale of the problem facing children in Uganda who need surgery is not insignificant. However, with a well-established network of hospitals across the country and outstanding local expertise, the Permanent Secretary's request for a plan is considered to be both timely and achievable.

The Taskforce convened and have developed a recommendation to develop from the current level of provision to a Super Hub, Hub and Spoke model whereby at least 21 paediatric surgeons and their associated teams will be employed by the end of 2027.

These surgeons will be based in either the Super Hub hospital (Mulago National Referral Hospital) or in one of 10 Hub hospitals, each with its own children's surgery Operating Room and dedicated staff.

Beyond this, Spoke hospitals (those General Hospitals already offering adult surgery) will be offered enhanced training for paediatric surgery. Covering the core surgical team, the training will allow more children to receive quality care closer to home. It will also enable referral pathways to strengthen, so the most in-need child get the right care in the right place and at the right time.

Building a comprehensive surgical service for every child in Uganda is possible. This report details the vital first steps needed to make it happen. With costs estimated at roughly one million US dollars a year for five years, the development of children's surgery will enhance local infrastructure, train local experts, sustain equipment and build a system that can genuinely care for our children.

Dr. Charles Olaro, Taskforce Chair

INTRODUCTION AND BACKGROUND:

Access to timely, safe and affordable surgical care for children is a key component of achieving Universal Health Coverage (UHC). Although many countries in the world are now implementing UHC, surgical services have not been adequately considered as an integral component of an essential healthcare package. The burden of surgical disease is high and different age groups have different needs. The Lancet Commission on Global Surgery (LCoGS) reported that 5 billion people do not have access to surgical care when they need it (1). There are currently more than 2.2 billion children on Earth, nearly two billion of them are living in low- or middle-income countries like Uganda.

Of this number, 1.75 billion are believed to lack access to surgical care (2) and it is estimated that a child born in sub-Saharan Africa has an 85% risk of requiring surgical care by age 15 years (3). Indeed, 6%–12% of all paediatric admissions in sub-Saharan Africa annually are surgical, although the proportion may be higher in some urban areas (4). Further, about one-third of patients admitted to a surgical department at a Regional Referral Hospital in Uganda, during a 3-year review, were below 18 years of age. However, these hospitals were ill equipped to provide care with patients, at best, being unnecessarily referred to Kampala (leading to excessive patients for the national referral centre) or, at worst, receiving inadequate or no care at all. This makes a strong case for the development and implementation of a surgical care plan for children in Uganda (5). Implemented fully, such a plan should have the potential to significantly improve care, unlock existing resources and be an example within the region for what can be achieved at relatively low cost.

Following the LCoGS, on 29 January 2015, the World Health Organization (WHO) Executive Board unanimously adopted a draft resolution on *“Strengthening emergency and essential surgical care and anaesthesia as a component of universal health coverage”*. Addressing surgical care started to appear in global policy documents and countries committed to ensuring that they strengthen surgical care locally. A number of countries in sub-Saharan Africa, including Uganda, are now developing National Surgical, Obstetric and Anaesthesia Plans (NSOAPs) to ensure that improving surgical care is one of the government’s policy priorities. Despite this, access to safe, timely and affordable surgery for children continues to face a number of significant challenges.

This report aims to lay a pathway to overcome many of those challenges in Uganda by defining the first steps on the journey to high-quality surgical care for every child across the entire country.

There are many reasons for the lack of access to surgical care among children and these are well reported on and understood. A lack of workforce and inadequate infrastructure are typically the most common in LMICs. In Uganda, currently most of the Regional Referral Hospitals (RRHs) do not have appropriate and/or well designated paediatric surgical services despite the significant burden. Limited access to centres that provide children's surgery forces parents to travel long distances to seek surgical care for their children. Access to surgical care involves not only paying for surgical services but also non-medical costs, such as transportation, lodging and food. In addition to time out of work, which is usually unpaid, all these factors frequently contribute to catastrophic expenditure being incurred when a child has a surgical need. Yet, investing in surgery for children has been shown to be both cost-effective and has a significant positive return on investment for the national economy (6,7).

Uganda Context

Uganda is a landlocked country in East Africa, lying astride the equator, bordered (clockwise from north) by South Sudan, Kenya, United Republic of Tanzania, Rwanda and the Democratic Republic of Congo. In 2020, the population of Uganda was estimated to be 45.7 million people, 21 million (46% of the total population) were under the age of 15 (8). In Uganda, children treated under paediatric surgery are up to the age of 18.

About 74.3% of Uganda's population resides in rural settings where significant poverty can limit their access to services including surgical care (8). Contributing to the inaccessibility of healthcare for children's surgery is a lack of trained workforce and child appropriate equipment in the general/district level hospitals (first level/rural hospitals).

Uganda's health facilities are stratified into 7 levels based on the services they provide and the catchment area they are intended to serve, General Hospitals (GH), Regional Referral Hospitals, and National Referral Hospitals as the topmost level facilities in this structure. There are 16 Regional Referral Hospitals and 62 GHs in the country. The health system of Uganda encompasses the public and non-public sectors with programs providing preventive,

promotive, curative and rehabilitative services relating to various communicable and noncommunicable diseases and health conditions.

With a well developed hospital infrastructure across the country, the lack of provision for children’s surgery, something that almost half of the population ought to have access to, is an omission that can be rectified at relatively low cost when integrated to the existing services.



Figure 1: The Map of Uganda

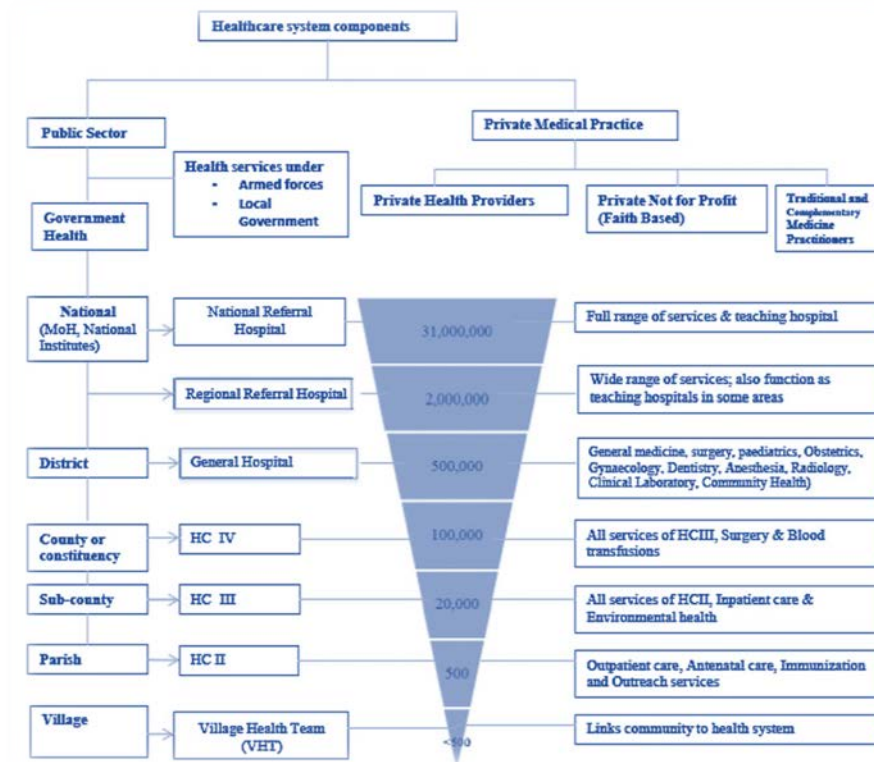


Figure 2: Hospital levels of in Uganda

Rationale for Developing National Children’s Surgery in Uganda

To facilitate implementation of the DCP3 and LCoGS recommendations, a growing number of countries are developing National Surgical, Obstetric and Anaesthesia Plans. National surgical plans are an iterative process where stakeholders use country-level data to develop a contextually relevant and sustainable plan to ensure that surgical and obstetrical services are available for an entire country or region. In 2019, Uganda had an overall annual surgical volume of 144.5 cases per 100,000 people per year, far below the LCoGS recommended threshold of 5,000 procedures per 100,000 population (1,9).

Unmet surgical need in Uganda is prevalent with over 3.5 million individuals having unmet surgical need, of whom 1.4 million require surgical treatment (10). Uganda is estimated to have approximately one surgeon per 100,000 people and only 0.2 major operating theaters per 100,000 people, again far below the recommended targets (4). This calls for an urgent need to expand the surgical care delivery system, as well as implementing routine surgical data collection (10).

The National Surgical, Obstetric and Anaesthesia Plan (NSOAP) has been developed as a policy strategy for countries to address, in part, the health burden of diseases amenable to surgical care (11). Countries in Africa are in various stages of developing NSOAPs. In Uganda, the Ministry of Health has started developing a NSOAP in collaboration with various stakeholders to strengthen surgical systems. However, experience has shown that children's surgery has received limited priority in these plans. In developing NSOAPs, existing health policies should be considered and analyzed to avoid redundancy and identify opportunities for collaboration, pooling of resources, and synergy. This report will complement the ongoing efforts to specifically include the needs of children in the wider health agenda in Uganda. Children develop distinct surgical conditions, present unique anaesthetic challenges, and have special perioperative needs (12,13). Without proper planning, diseases requiring surgical care will result in an immense and preventable burden on existing health care systems, diverting resources from other priorities. The consequences of paediatric surgical conditions are often lifelong since they affect children at critical times during development. Minimizing acute and long-term suffering, protecting families from substantial economic losses and increasing economic productivity can all be achieved through an investment in surgical services for children (12,13).

There is a great gain in addressing surgical care for children and its role in achieving health-related sustainable development goals and targets. In particular these include:

1. Ending preventable deaths in new-borns and children under five
2. Reduction in death and disability from road traffic injuries and non-communicable diseases
3. Ensuring Universal Health Coverage
4. Scaling up the health workforce [8]
5. Enhancing global health partnerships
6. Reducing poverty by supporting families affected by surgical disease in children
7. Improving gender equity through reducing caregiver burden, especially for mothers
8. Supporting economic growth through realization of human capital
9. Supporting children to fully engage in education

Hence, for a country to achieve Universal Health Coverage (UHC), it is important to ensure that these children lacking access to surgical care are given the required attention – hence this plan.

AIM OF THE PLAN

This document details an action-orientated and implementable plan to deliver a national focus for all stakeholders in children’s surgery in Uganda. It does not pretend to deliver the end goal of timely and affordable access to safe surgery for all of Uganda’s 21million children. However, it presents an opportunity for the first steps towards that to be nationally coordinated, ensuring all of those investing in this area have a common goal in a reasonably short timescale.

This plan for developing paediatric surgery in Uganda over the next 5 years, from 2023 - 2027, is a framework that serves as a guidance to both internal and external stakeholders and funders to ensure that children’s surgery develops in a coordinated way that is in-line with local priorities and guided by the Ministry of Health.

PROCESS OF DEVELOPING UGANDA CHILDREN’S SURGERY PLAN

This report has been developed using a Participatory Approach, where all the key stakeholders were involved in meetings to design the implementation strategies based on local priorities. A Situation and Gap analysis was conducted to inform the development of strategies to improve access to children surgery. The planning process included the following steps:

1. A Situation and Gap analysis to identify the existing situation and the gap existing in the provision of children’s surgery.
2. Literature review of the existing literature.
3. Site visits of the identified potential priority hospitals¹.

¹ These site visits have been delayed due to the outbreak of Ebola and the demands this placed on many MoH members of the working group. A remote survey process can be deployed with site visits to be carried out in early 2023.

Informed by previous studies on stages of developing NSOAPs(11), we analysed baseline indicators on children's surgery provision, identified possible partners and local champions and did a broader stakeholder engagement. Through a series of meetings, we came up with a consensus on the ideas suggested, then refined the language to ensure that it is clear to readers. Lastly, we came up with an implementation plan, which included a costing projection ready for dissemination.

Key Stakeholders: Ministry of Health and Kids Operating Room

The idea to develop a Children Surgery National Plan came from the meeting on 4th July 2022 between the Permanent Secretary (PS) of the Ministry of Health of Uganda and the Chief Executive of the Kids Operating Room (KidsOR), a charitable organisation that works directly with Ministries of Health, local surgeons and their teams to transform surgical services for children. This includes the creation of Operating Rooms, pre-operative and post-operative spaces, training of surgical teams and delivery of engineering services (14).

A significant gap exists between high-income countries (HICs) and LMICs with more than 14 Operating Rooms per 100,000 population in HICs compared with an average of one Operating Room per 100,000 population in sub-Saharan Africa (15). KidsOR is working to address this disparity as a first step in ensuring access to safe surgical care among children and it has installed more than 60 Operating Rooms in 25 countries in Africa and Latin-America, creating a capacity for more than 40,000 operations on children every year. Many of these have been developed in partnership with Smile Train through a program of work that supports local training, enhances locally delivered care and ensures long-term sustainable delivery of quality care. Three Operating Rooms have already been equipped and furnished in Mulago National Referral Hospital with further investments in Naguru RRH, CoRSU Rehabilitation Hospital (delivered in partnership with Smile Train) and Mbarara RRH.

The PS and MoH agreed on the need to develop this national plan for Uganda and agreed on a timeline. They committed to developing a strategy for scaling up access to appropriate Paediatric Surgical services to National and Regional Referral Hospitals over the next five years. The MOH, through the PS, formed a taskforce to drive the development of children's surgery in Uganda. The taskforce comprised of: Representatives from the Uganda Ministry of

Health, Uganda Paediatric Surgeons and Paediatric Anaesthesiologists, Paediatric Surgery Nursing, Uganda Biomedical Engineering, KidsOR, Smile Train, UCSF and Children surgery researchers. This builds on prior efforts to join stakeholders to advance surgical care for children in Uganda by planning in training, infrastructure, service delivery and research (16).

Timeline and Process Map

The planning phase of this project was to take a total duration of 4 months to develop a report that will allow initial implementation of this initiative to strengthen paediatric surgical services and build towards safe surgery for every child in Uganda.

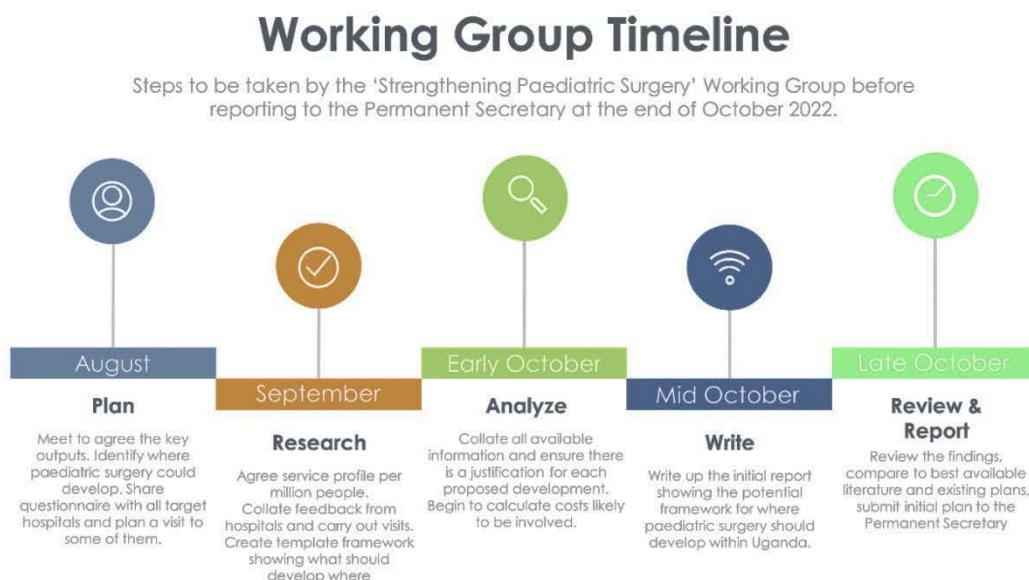


Figure 3: Process and timeline

Data sources included surveys that were sent to hospitals, a comprehensive literature review and evidence drawn from existing databases (REDCap and HMIS). A consultation and/or interview with providers and other stakeholders was also carried out to understand the equipment, engineering and workforce needs. All of these have been complemented by observation data from hospital visits, existing hospital knowledge or will be further supported after hospital surveys take place. The findings of this analysis are presented below to suggest the implementation plan based on the key NSOAP building blocks: Human resources,

Infrastructure, Service delivery, Financing, Governance, Information Management and Technology

SITUATION OF PAEDIATRIC SURGERY IN UGANDA:

It was important that the Taskforce conducted a thorough situation analysis since underutilization of procured equipment has been documented (30). Ensuring the plan put forward matched infrastructure with growth in the suitably qualified workforce will ensure maximum return on investment in the children’s surgical service.

Surgical volume:

A 2021 multi-facility study reviewing children’s surgical procedures from the National Referral Hospital (NRH), all 14 regional referral hospitals (RH) and 14 general hospitals (GH) in Uganda, reported the annual rate of paediatric surgery in Uganda as 22 operations per 100,000 children (17). This corresponds with 4.9 to 7.6% of the estimated paediatric population in need of a major surgical procedure in 2014 (17).

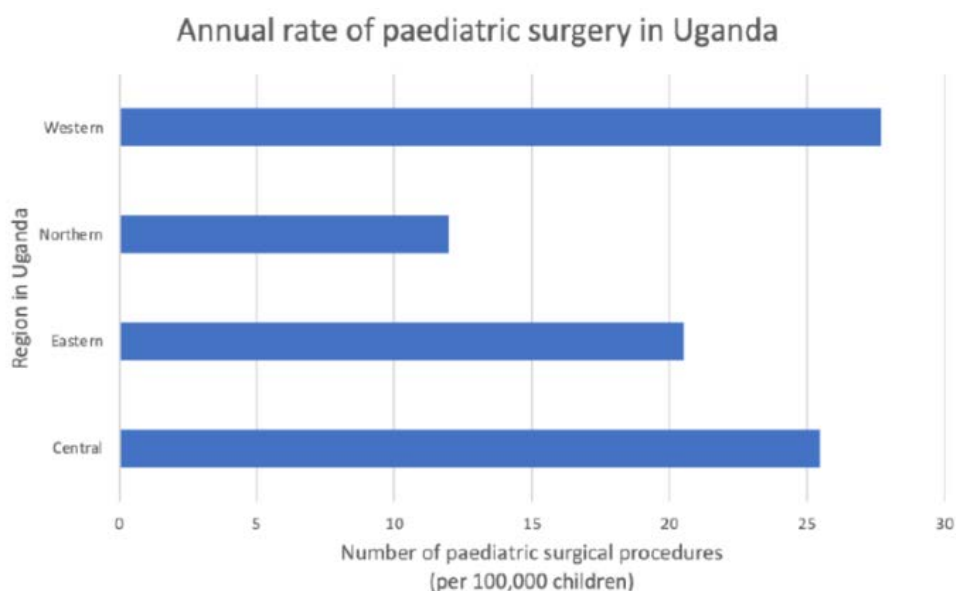


Figure 4: Annual rate of paediatric surgery in Uganda

Figure 4: *Annual rate of paediatric surgery in Uganda by region. Data sourced from Ajiko, et al. "Surgical procedures for children in the public healthcare sector: a nationwide, facility-based study in Uganda." BMJ open vol. 11,7 e048540. 13 Jul. 2021*

The most common children's surgical conditions in Uganda are congenital anomalies, trauma and infections (17–19). The Northern region is reported as the most underserved with the fewest hospitals and farthest distance to a national referral hospital. General hospitals most commonly perform hernia repairs and are able to offer the necessary intermediate surgical procedures, but at lower rates than is needed (17).

Density and distribution of the paediatric surgical and anaesthetic workforce

Uganda has 7 paediatric surgeons and 2 paediatric surgical fellows due to sit their final exams and graduate in December 2022, serving approximately 21 million children. All of the paediatric surgeons work in Kampala or the Mbarara Referral Hospital in Western Uganda (20). It has been reported that specialist surgeons (general, paediatric, GYN, ortho, CT, plastic, NSGY, ENT or urology attendings) perform approximately 60% of these children's surgical procedures, with the remainder performed by residents (14.5%), non-specialist (aka non-surgical) physicians (20.5%) or interns (3%) (17). As the multi-facility study mentioned previously, of the 275 physicians who performed procedures only 3 were paediatric surgeons. There were 103 surgical specialists in the study, 57 surgical residents and 115 were physicians without surgical training (17).

This study also looked at the prevalence of anaesthesia providers in Ugandan hospitals. Anaesthesia was administered by an anaesthetist attending in only 11.6% of cases with the remainder being done by anaesthesia residents (10.4%) or an anaesthetic assistant or anaesthetic officer (69.4%) (17). The Ministry of Health have only a quarter of the 359 anaesthesia human resource required in Uganda to match the Health Sector Development Plan 2020, less than 30 are registered public sector anaesthesiologists(21,22). There were 55 ICU beds making up a ratio of 1.3 ICU beds per million population (23).

There are no reported paediatric surgeons at major referral hospitals in Northern Uganda (Lacor in Gulu) or Eastern Uganda (Soroti), which are 291km and 334km respectively from Kampala equating to 6 to 10 hours of travel time. Paediatric surgery does occur in these

hospitals, however, with each hospital's general surgeons performing approximately 300 elective and emergent paediatric cases per year. The paediatric surgical mortality rates at these two hospitals range between 1% to 2.4% (20). Limited access to a healthcare service has already been documented in Uganda, using a case of limited ICU capacity in the regional hospital leading to overcrowding of patients in the national referral hospital (24). This compromises the quality of care even in these places where it is available.

The unmet need of paediatric surgery

In a cross-sectional study looking at prevalence of paediatric surgical conditions in Eastern Uganda, published in 2022 (18), 16% of the 1581 children from 490 households had a surgically treatable condition. Of these children, 39% had an unmet surgical need, which suggests that the population-wide prevalence of children with an unmet surgical need in Uganda is 6.3% (c.1.32 million children). When looking at children who do manage to present at hospital with a surgically treatable condition, data from Mulago and Mbarara Hospitals stated that 10% of children required immediate admission of which 54.2% recovered or received an operation, however, 37.5% had their surgery postponed. A total of 56% of children in need of elective surgery in the near future were denied due to ward capacity or equipment issues (25) which shared similar results to a survey in 2018 that found 50% of a cohort of children seeking surgical care did not receive it (26). A more recent analysis using data from Mulago, Mbarara, Soroti, and Lacor Hospitals estimated that surgical rates per 100,000 children are approximately 1% of those from the United States and Canada, and also found that a substantial portion of the burden of disease for emergencies in children are met at regional hospitals such as Lacor and Soroti (20).

Furthermore, exacerbation of back logs and wait lists for surgery in children have been profound during the COVID pandemic, with an additional backlog of nearly 1,000 children from Mulago Hospital alone, and an estimated cost to the Ugandan economy of 23 million USD (27). This data coupled with the experience from other similar LMICs highlights the need for urgent mitigation strategies that will also lead to sustainable health system development.

Accessibility of paediatric surgery

The perceived barriers to accessing paediatric surgery have been reported as geographical (including transportation barriers), discrimination, caregiver limitations to support recovery, awareness of surgically-treatable conditions and financial barriers (28,29). Studies focusing on the reasoning for delayed seeking of surgical attention found that stigma, fear of surgery and anaesthesia, family power dynamics, misdiagnosis and lack of knowledge and mistrust of the healthcare system were all key factors. Some families also sought care from traditional methods before seeking hospital care for their child's surgical condition (29).

Social and financial barriers have been shown to contribute heavily to accessibility of, and care-seeking behaviors for, paediatric surgery. In a survey of Ugandan community members and parents of children with congenital anomalies in 2021, 100% believed that seeking surgical care would lead to poverty (30). Furthermore, 43% of respondents believed that fathers would abandon children who needed surgery, 26% thought that a child with a congenital anomaly in their community had been left to die, and many believed that the causes of congenital anomalies were linked to contraceptive methods, witchcraft or drugs. Surveys such as these highlight the need for increased knowledge distribution and understanding of surgically treatable conditions and for more socially and financially accessible paediatric surgical services in Uganda.

IMPROVING PAEDIATRIC SURGICAL SERVICES IN UGANDA

Several studies have discussed strategies in which to improve paediatric surgical delivery and accessibility in Uganda. Poor access to paediatric surgery in Uganda is caused by a number of factors, which a study by Kakembo et al have grouped in to three stages of delay in paediatric surgical care:

1. The decision to seek care
2. Accessing a health facility
3. Receiving adequate care (25)

Looking into these delays, we see a great contribution to the key indicators as documented in the LCoGS. Hence, as we think of the interventions to improve access to paediatric surgical

care, we aim to ensure that delays are addressed at various levels. The ways in which to combat these delays have been presented for each stage and a key solution is thus to ensure the whole children's surgical system is being addressed.

The first delay would be improved with an increase in deliveries with skilled birth attendants and community education regarding common surgical conditions in children with understanding of the importance of early intervention. The second delay would potentially be mitigated by availability of community transportation, ambulances, health insurance and good referral systems to tertiary hospitals. The final delay requires infrastructure development at tertiary, district and regional hospitals and the training of paediatric surgeons and anaesthesiologists, to allow for improvement (25).

While the Taskforce notes that the first two delays are beyond the scope of this report, it is recommended that they should, nonetheless, be investigated and may benefit from a similar focused approach to develop a pathway for growth.

Model for Developing Children's Surgery

We propose to adopt a ***Super Hub – Hub – Spoke Model*** to promote the comprehensive development of a children's surgical care system. This will ensure that there is sharing of resources, continuous mentorship and better communication through referral networks with lower healthcare levels. This model has been used in neighbouring country, Tanzania, and has the potential to decentralize paediatric surgery care to the wider health system, taking care closer to the patients who need it.

In this model, a Super Hub is equipped with better resources to provide specialist and superspecialist care. A Hub has all the required resources to provide general paediatric surgery while receiving support from the Super Hub with the option to refer patients needing more advanced care to the Super Hub hospital. Required infrastructure will need to be installed in the Hub hospitals and support provided to the Super Hub.

It will be required to enhance identified Hub hospitals by developing the infrastructure and placing qualified paediatric surgeons and their teams in these hospitals. Once they have the required capacity, Hub hospitals will support the Spoke hospitals - those district/general

hospitals who do not have qualified paediatric surgical teams but who do provide surgical care for children.

These Spoke hospitals will require additional training of surgeons, anaesthesia providers and nurses to ensure they can provide a comprehensive service while knowing they can refer complex cases. Such a model ought to prevent inappropriate referrals and keep as much care close to home as is safely possible.

The Hub and Spoke model arranges service delivery into a network consisting of a central establishment (Hub) that offers a full array of services, complemented by primary establishments (Spokes) that offer more limited-service arrays, routing patients needing more intensive services to the Hub for treatment. The most complex cases will be referred to the Super Hub. Hub and Spoke networks afford many benefits for healthcare providers, but in order to capitalize fully, proper assembly is required (31). The Hub and Spoke model is an effective care delivery model in situations where there is constrained physical capacity and human resources to match the burden of disease. Some aspects of organisation of health services delivery in Uganda already function with a Hub and Spoke model where referral units like RRHs act as a hub for the GHs, and each subsequent level acts as a hub for the lower levels.

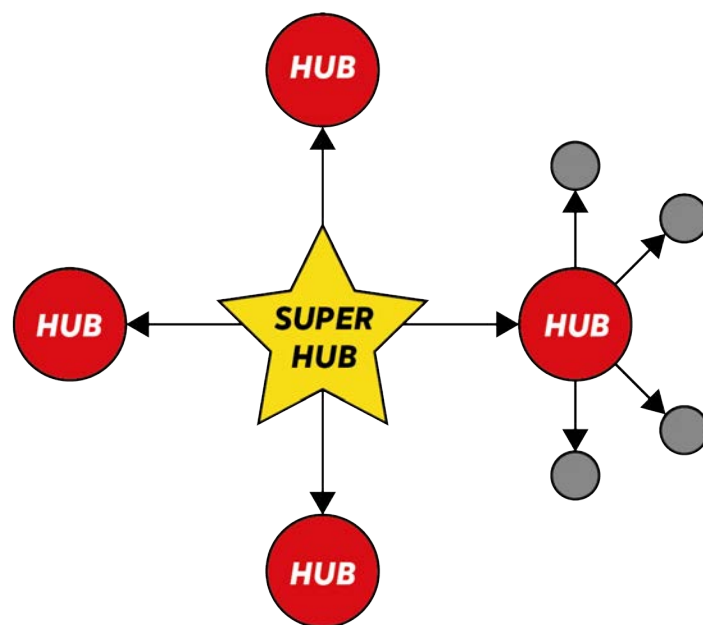


Figure 5: Super-Hub, Hub and Spokes Model

Proposed Super-Hub

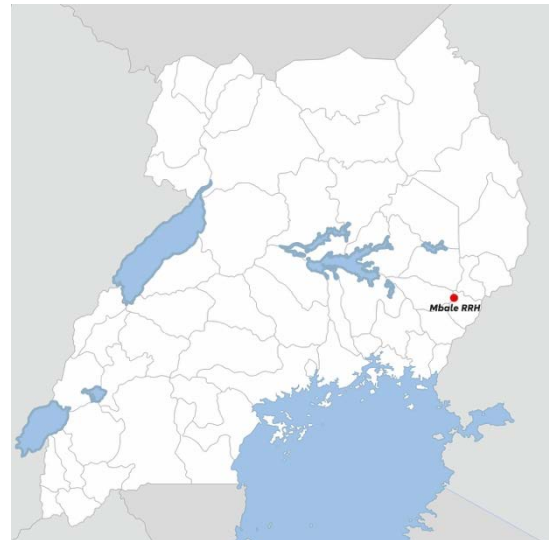
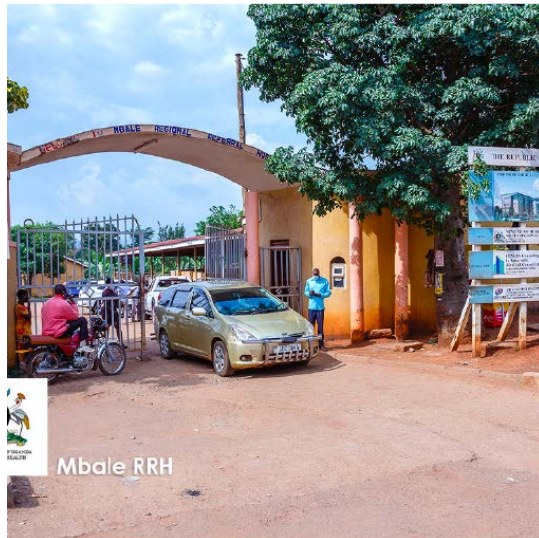
The best place for the Super-Hub is the Mulago National Referral Hospital where the existing paediatric surgery team have a well-established, well-resourced and highly performing team.

Proposed Hub Hospitals

Ten Regional Referral Hospitals (RRH) have been identified as suitable places where Paediatric Surgical Services can be developed. Identification was based on location, capacity and availability of the key resources needed to develop children surgery, including the rooms for installing children's Operating Rooms. Additionally, identified Hub hospitals were those affiliated to a Medical School or a University. These are Mbale RRH affiliated to Busitema University, Mbarara RRH to MUST, Kabale RRH to Kabale University, Masaka RRH to Equator University, Gulu RRH to Gulu University, Lira RRH to Lira University, Soroti RRH to Soroti University, Arua RRH to Muni University, Hoima and Fort Portal RRH to Kampala International University. Remote surveys of these hospitals began in October 2022 and will be followed by in person visits in early 2023. In addition, Health Management Information System (HMIS) data of surgical volume from these hospitals will be reviewed, as well as data from a comprehensive regional hospital survey (pre COVID) led by the AAU, to identify specific areas of emphasis. It will be important to ensure that target hospitals can ensure safe delivery of essential general (adult) surgery and perioperative care through the existing platform to ensure that the addition of children's surgery and required workforce will have the intended impact.

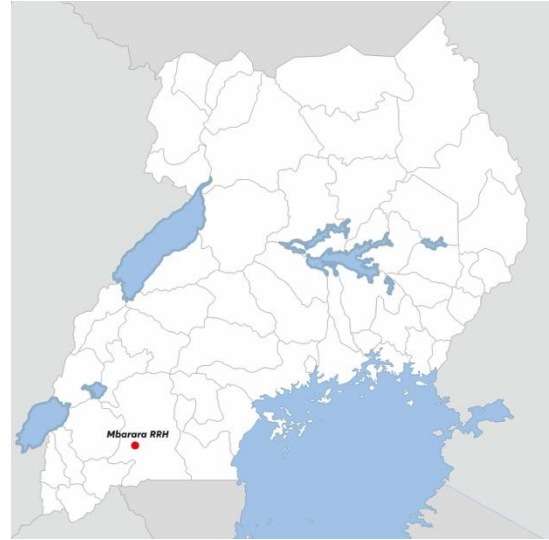
List of Identified Hub Hospitals:

1. Mbale Regional Referral Hospital



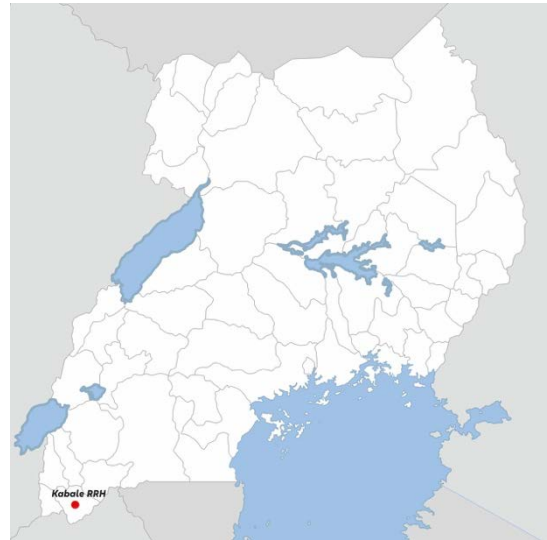
Mbale Regional Referral Hospital is located in Eastern Uganda, being the main referral hospital for Busia, Budaka, Kibuku, Kapchorwa, Bukwa, Butaleja, Manafwa, Mbale, Pallisa, Sironko and Tororo districts. Mbale Referral Hospital is a 415 bed facility that serves around 4.7 million people from 14 districts in the Eastern Region of Uganda. In 2019, it was shown that Mbale had 454 beds, 4 operating theatres and a 30-days operative volume of 399 (9). Over 10,000 babies are born at Mbale Hospital every year, almost double the number born in an average UK hospital. A children's ward with 20 beds and basic equipment to treat end stage malaria can have 120 children. On any given day there can be 2 –6 children per bed. Although Mbale has power supply from the town grid and its own on-site back-up diesel generator, the Hospital is plagued by frequent load shedding and unreliable, insufficient electricity supply. Lack of reliable electricity seriously affects the Hospital's ability to provide basic as well as urgent and emergency surgical procedures and severely impacts critical supplies and services. Mbale Regional Referral Hospital is the largest healthcare institution in the Eastern region and houses the region's only endoscopy department.

2. Mbarara Regional Referral Hospital



Mbarara Regional Referral Hospital is the largest teaching and referral hospital for southwestern Uganda, which has a population of 9 million people living in a predominantly rural, agrarian setting. It has a dedicated Operating Room for children's surgery, provides general and specialized care and has capacity to carry out diagnostic and therapeutic investigations. It has a bed capacity of approximately 300 beds and is affiliated with MUST. The hospital has multiple specialists and sub-specialist capacity, with clinical departments including outpatient, Obstetrics/Gynaecology, Anaesthesia, Microbiology, Pathology, Radiology, Paediatrics and Child Health, Internal Medicine, Surgery, Pharmacy and Dental. In 2019, it was shown that Mbarara had 451 beds, 4 operating theatres and a 30-days operative volume of 570 (9). Mbarara Regional Referral Hospital does have an existing Operating Room for paediatric surgery.

3. Kabale Regional Referral Hospital



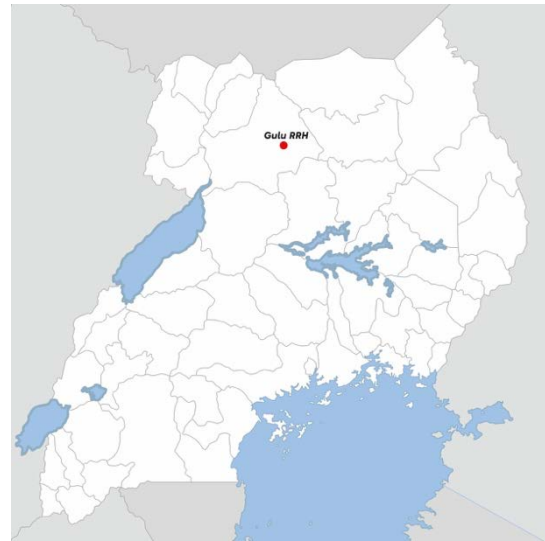
Kabale Regional Referral Hospital is a 280 bed hospital located in Kabale Municipality in Southwestern Uganda, approximately 426 Kilometers from Kampala. The hospital serves a population of about 2 million people in the districts of Kabale, Kisoro, Rukungiri, Kanungu, and some parts of Ntungamo as well as people from neighbouring countries of Rwanda and the Democratic Republic of Congo. The mission of the hospital is to provide quality and sustainable, general and specialised health services to all people in Kigezi region.

4. Masaka Regional Referral Hospital



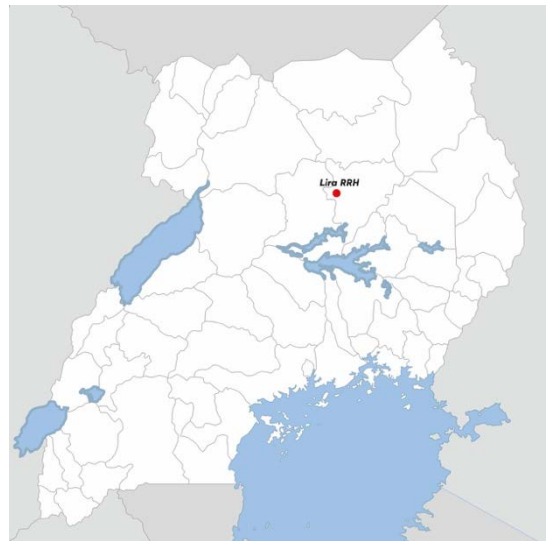
The hospital has a 330-bed capacity with an annual admission of 23,456 patients giving a bed occupancy rate of 90.6%. However, with the completion of a new mega hospital facility, the bed capacity is expected to increase to about 540 beds. Masaka Regional Referral hospital offers all services expected of a regional referral health facility but also offers nutritional support for both children and adults. Currently the hospital has 5 functioning operation theatres with a 30 day operative volume of 294.

5. Gulu Regional Referral Hospital



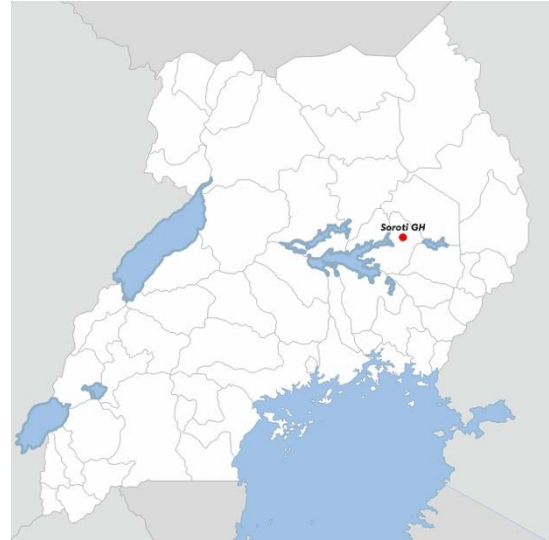
Gulu Hospital is located in Gulu, Northern Uganda. The hospital serves a wide catchment area. It is a referral hospital for the districts of Amuru, Gulu, Kitgum, Lamwo and Pader. Gulu Hospital is a regional referral centre for patients from Northern Uganda, also receiving patients from neighbouring countries, for example, South Sudan and the Democratic Republic of Congo. It is also a teaching hospital for Gulu University Medical school and many other health training institutions in the region. It is a 400 bed capacity hospital with outpatient and inpatients services estimated at 120,000 patients every year. It has 5 functioning Operating Rooms with a 30 day operation volume of 163. The hospital admits more patients than the required number due to high demand in the northern region, which is common in most other hospitals in LMICs. The Hospital has specialized units including surgery and paediatrics, having consultants from both Gulu Hospital and Gulu University.

6. Lira Regional Referral Hospital:



Lira Regional Referral Hospital is a hospital in Lira in the Northern Region of Uganda. It is the referral hospital for the districts of Amolatar, Apac, Dokolo, Lira, Kole, and Oyam. Lira Regional Referral Hospital is located approximately 339 kilometres (211 mi), by road, north of Mulago National Referral Hospital. Lira Hospital is a public hospital, funded by the Uganda Ministry of Health and general care in the hospital is free. The hospital has a capacity of 400 beds, an annual inpatient admission of 18,000, and an annual outpatient department attendance of 200,000 patients. It has 4 functioning Operating Rooms with a 30 day operation volume of 196.

7. Soroti Regional Referral Hospital



Soroti Regional Referral Hospital, commonly known as Soroti Hospital, is a hospital in the city of Soroti, in Soroti District, Eastern Uganda. It is the main referral hospital for specialized surgical care in the Teso sub-region (the districts of Amuria, Bukedea, Kaberamaido, Kapelebyong, Katakwi, Kumi, Ngora, Serere and Soroti and other neighbouring districts), representing the second-highest level of care within the national health system(32). SRRH serves a catchment area of approximately two million people. The bed capacity of Soroti Hospital is 274 as of October 2020, 2 functioning operating tables and a 30 day operation volume of 266.

Patients continue to face a number of significant delays as a result of deficits in infrastructure, workforce and lack of capacity for emergency surgery. The hospital serves 21,000 inpatients and 103,000 outpatients yearly, having one Operating Room with two operating tables, where two operations can be occurring simultaneously. A median of 32.5 operations are done monthly by two attending general surgeons, two attending gynaecological surgeons, and three nurse anaesthetists.

8. Arua Regional Referral Hospital



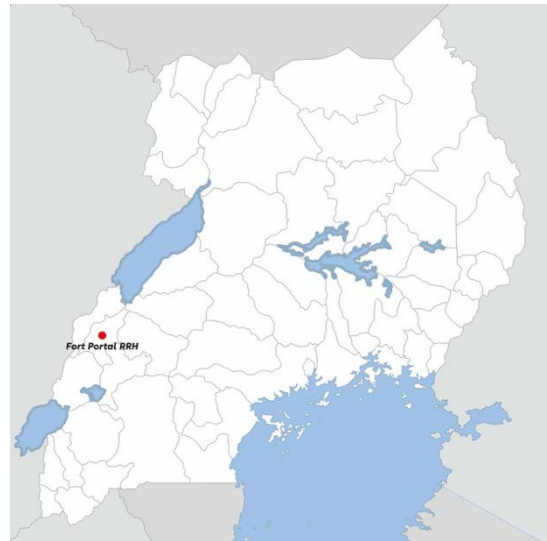
Arua Regional Referral Hospital, commonly known as Arua Hospital, is a hospital in the town of Arua, in Northern Uganda. It is the referral hospital for the districts of Adjumani, Arua, Koboko, Maracha, Moyo, Nebbi, Yumbe, and Zombo. The hospital also receives referrals from neighbouring parts of South Sudan and the Democratic Republic of the Congo. The bed capacity of Arua Hospital is quoted as 272, although the hospital admits far more patients due to the high demand in the northwestern region. It is a public funded hospital and managed by the Uganda Ministry of health.

9. Hoima Specialized Referral Hospital



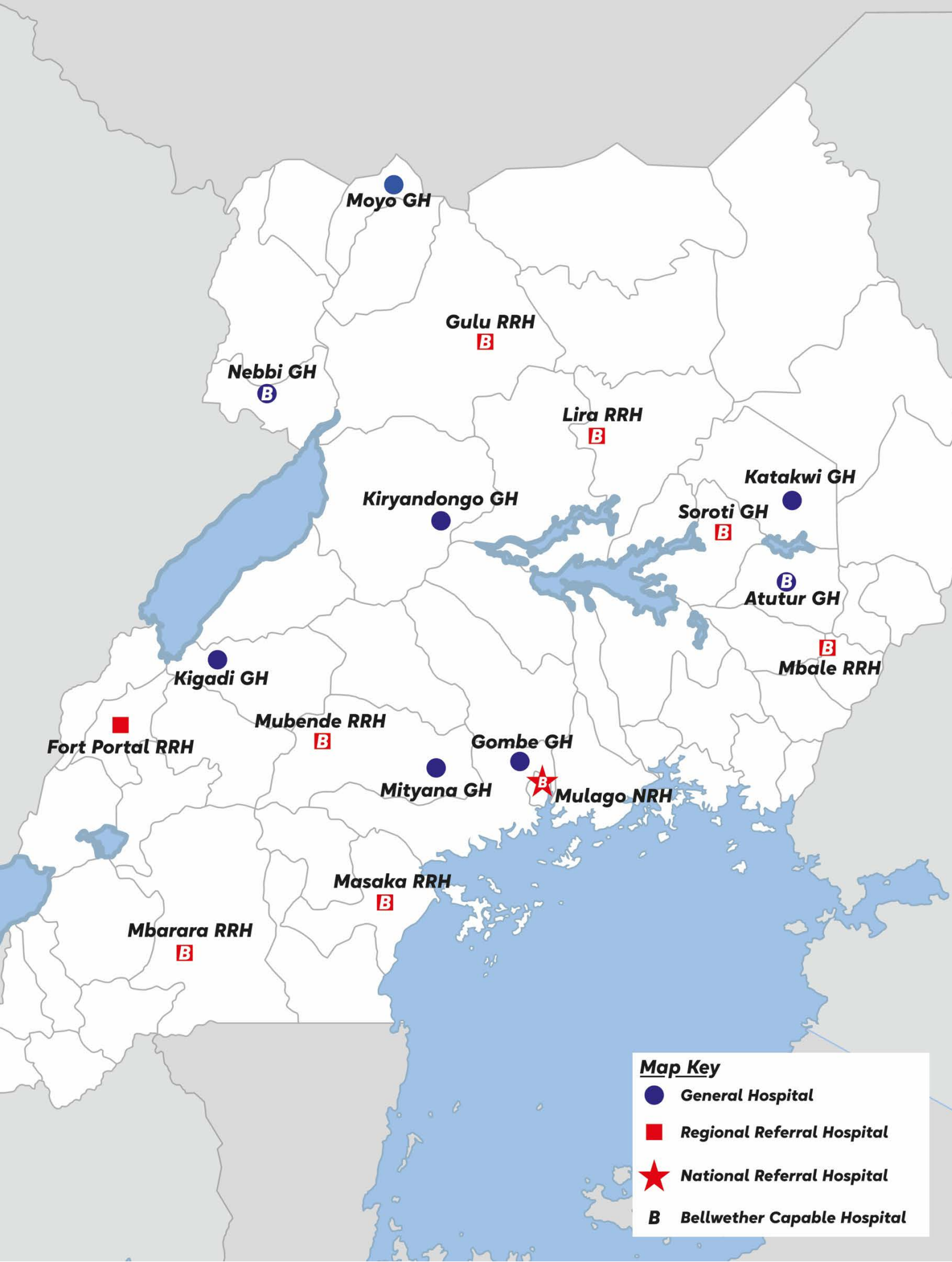
Hoima Regional Referral Hospital is located in Hoima Municipality, about 200 km west of Kampala. The hospital caters for populations of the Greater Bunyoro Region, encompassing the districts of Bunyoro viz: Hoima, Kibale, Masindi, Bulisa, Kiryandongo, Kyankwanzi, Kiboga and the Eastern part of DR Congo; overall grossing over 3 million people. The present bed capacity is 300. It is the main referral hospital for the district of Bulisa, Hoima, Kakumiro, Kagadi, Kabaale, Kikube, Kiryandongo and Masindi. The hospital offers services in most medical and surgical subspecialties including dentistry, emergency medicine, paediatrics and intensive care among others.

10. Fort Portal Regional Referral Hospital



Fort Portal Regional Referral Hospital, commonly known as Fort Portal Hospital, sometimes referred to as Buhinga Hospital, is a hospital in the town of Fort Portal, in Kabarole District, Western Uganda. It is the referral hospital for the districts of Bundibugyo, Kabarole, Kamwenge, Kasese, Ntoroko and Kyenjojo. The bed capacity of Fort Portal Hospital is quoted as 372 and having 5 functioning Operation Rooms and a 30 day operation volume of 273.

Figure 6: Showing distribution of Hub Hospitals



WORKFORCE DEVELOPMENT

Proposed Training for General Hospitals

In this 5 years plan, the aim of the Taskforce is to include both specialist and superspecialist training mainly at the identified Superhub and Hubs, as well as children's surgery procedures training to General Surgeons at General Hospitals. This training for General Hospitals will build the whole team providing surgery for children (surgeons, orthopaedic surgeons, anaesthesia providers, theatre nurses, critical care nurses, and a children's surgery researcher). Support for engineering, either through the deployment of more training and/or more people, will also need to be considered.

The Ministry of Health has developed a costed plan to support specialist training, retention and recruitment of a quality workforce. Availability of specialists to deliver tertiary services to the population will improve access to the underserved population, reduce the cost of treatment and prevent loss of revenue in medical tourism. There is already an existing training program for paediatric surgery through the College of Surgeons of East Central and Southern Africa (COSECSA) either starting from Membership training (MCS) if a trainee enters training as a Medical Doctor or Fellowship training (FCS) for those trained in general surgery or those who have completed MCS training. The same is for Paediatric anaesthesia through the College of Anaesthesiologists of East Central and Southern Africa (CANECSA). Developed Hubs will eventually be able to continue training and sustainably develop the workforce density in the country.

Additionally, since 2018, Ugandan Paediatric Surgery Providers have developed and implemented a Paediatric Emergency Surgical Course (PESC) in four regional sites. This course targets Medical Officers, General Surgeons and Anaesthesia providers to help them trouble shoot children needing urgent surgical care. The PESC has been supported by GPAS/Yale and now UCSF-CHESA. The team has also piloted a course for midwives, paediatric nurses, paediatricians and obstetricians at the same capacity. Anaesthesia leaders have also rolled out SAFE Paediatric training (a WFSA course) regionally throughout Uganda to strengthen paediatric anaesthesia services at regional hospitals (33).

A similar training program has been identified that has been developed by the Global Initiative for Children Surgery (GICS) using a ‘train the trainers’ model. The children’s surgical providers in a tertiary level institution from a LMIC (CMC-Vellore, India), in collaboration with the Royal College of Surgeons of England (RCSEng) and Kids Operating Room, have initiated the training of a core adult team of anaesthetist, general and orthopaedic surgeons and nurses (ward and operating room) from General/District hospitals or other lower-level hospitals with no paediatric surgical care specialists.

The training will take place in Vellore, India in February 2023 with funding from KidsOR specifically for African teams who will come back and run the training course in General/District hospitals in their own country. Teams from Kenya, Ethiopia, Tanzania and Malawi are already participating.

This program has been reviewed by the Ugandan surgical team to assess the appropriateness of this training and it has been agreed that it would be beneficial to patient safety for this training to be incorporated in this plan as one of the strategies to improve Children’s Surgery in Uganda. As a fully funded program, participation in the training will start in 2023 with roll-out to General Hospitals later that year. Experience has suggested that training in the local context may be most beneficial, preventing the need for future sessions to be held abroad. This is thought to be a viable goal of the strategy for developing children’s surgery over the next five years.

Proposed target workforce

Currently, Uganda has 9 paediatric surgeons. With the existing population of 21 million children under the age of 18 in need of surgical care, it could be argued that Uganda needs 210 paediatric surgeons with their associated anaesthetists and wider teams. This is informed by international standards that recommend 1 paediatric surgeon per 100,000 children.

For the first 5 years of implementing this plan, the Taskforce agreed an initial target to have 21 paediatric surgeons with their associated teams, which is 10% of the required total to meet the country-wide needs of Uganda. These will be distributed in the Super Hub and Hub hospitals.

For anaesthesia there is an existing training program in place within Mulago National Referral Hospital that forms part of a continent-wide anaesthesia development plan for paediatric anaesthesia. The training takes one year to complete and placing two trainees a year onto the program for the duration of the five-year plan would ensure there was a qualified paediatric anaesthesiologist available to each of the ten priority RRHs by the end of 2027.

These paediatric anaesthesiologist should be deployed to a RRH with a further anaesthesiologist (adult qualified only) to ensure there was an appropriate system in place to up-skill the local workforce, sustain training and quality service delivery in General Hospitals and put in place a sustainable service for all patients, including children, at every RRH. Such an approach will transform care in these districts.

Previous NSOAP development efforts have shown their difficulty of funding the plans once they have been developed. Recent experience from Nigeria showed success in catalysing funding part of the plan by tackling children's surgery first. A drive to scale children's surgery should be integrated carefully with other streams of workforce and capacity expansion in Uganda (anaesthesia, critical care, child health).

In addition, recruitment and retention of specialist surgery and anaesthesia providers to rural hospitals has been a major challenge in Uganda (and other LMIC). Recent work has suggested that recruiting pairs (surgery and anaesthesia) and ideally as teams of providers, with added incentives of housing, and some allowance, is a preferred approach according to Ugandan clinicians (34). This approach has been successfully piloted and should remain an option worth considering if recruitment proves to be difficult.

Across Uganda, like many countries in the region, a recognised lack of dedicated paediatric Operating Room nurses can further hamper efforts to bring equitable access to care. As the surgeon and anaesthesia workforce is scaled up, so too should the number of trained theatre nurses capable of supporting the delivery of care be enhanced.

A focused effort to encourage existing nursing staff to undertake further training where they specialise in theatre nursing should be made during the next five years.

The Cost of Infrastructure Ownership - Biomedical Engineering Capacity

Building capacity to the 10 selected Hub hospitals will need a concurrent investment of Biomedical engineering capacity in Uganda. A detailed list of equipment has been developed for a Hub hospital to include in the theatres (Appendix II), which also proposes the inclusion of laparoscopic and endoscopic equipment in these Hubs.

Members' own experience, supported by many studies, have shown the existence of 'medical equipment graveyards' of obsolete or broken donated biomedical equipment in hospitals across low-income and middle-income countries including Uganda. A chronic underinvestment in equipment maintenance and repair, and inappropriate design of medical equipment for low-resource settings has resulted in an estimated 40% of healthcare equipment in LMICs being out of service, compared with less than 1% in HICs.

With this in mind, the Taskforce propose the following strategies:

1. **Standardization of equipment:** This is to ensure that the company and type of equipment being invested for children's surgery have local suppliers and/or country representatives. This is to ensure access to spare parts and disposables locally when needed. Additionally, to ensure that there is familiarity with the equipment by the biomedical teams when it is similar across many facilities.
2. **Building biomedical engineering capacity in Uganda:** It is recognised that additional engineering capacity will be needed to service and maintain the infrastructure as it rolls out to the Hub hospitals. More people armed with advanced calibration equipment will be needed to ensure the investments are serviced, maintained and to reduce downtime after installation. Practicalities around issues such as Internal transport will also need to be overcome. Models for developing this service have been discussed and options include:
 - i. the MoH recruiting and training more engineers and equipping them with the required equipment
 - ii. A contract being awarded for the maintenance of this equipment with that contractor working closely with the MoH engineering team to ensure minimum standards are always exceeded.

ANTICIPATED COST OF IMPLEMENTING THE PLAN IN UGANDA

Infrastructure development

Although individual assessments have not been completed, experience from developing children’s surgical facilities in Uganda and across sub-Saharan Africa allows for accurate assumptions to be made for the purposes of an initial budget.

These are as follows:

Detail	Price in Ugandan Shillings	Price in US\$
Super Hub investment needed	1.1bn	\$300,000
Hub Hospital investment required (Total for all 10 hospitals)	11bn	\$3,000,000

The above will provide additional equipment to Mulago Hospital and fully develop an Operating Room for children’s surgery in all 10 Hub Hospitals

Training costs

The training costs are relatively stable across the East Africa region and can be predicted to be as follows:

Detail	Price in Ugandan Shillings	Price in US\$
12 paediatric surgeons, assuming FCS level training only, spread over 5 years	5.7bn	\$1,500,000
Train 10 Anaesthesia Paediatric Anaesthetists over 5 years	958m	\$250,000
Train General Hospital teams	0	0 (Funding already secured)

Engineering costs – cost of ownership

Assuming a contract is awarded for the deployment of additional engineers to sustain the new infrastructure and work with the MoH team, a cost can be assumed per month, per hospital at approximately \$2,000 (US). There would be a phased opening of new infrastructure over the five years allowing an assumption of the total servicing and maintenance cost to be:

Detail	Price in Ugandan Shillings	Price in US\$
Contract for service and maintenance by Ugandan engineers fully trained and equipped with own vehicles etc. 5 team members at \$2,000 per month	2.3bn	\$600,000

The costs listed above do not include the salary costs of the surgeons, anaesthetists or any nurses also benefiting from the training. No salary costs for the engineers would be incurred under this proposal as they will be contracted.

Summary of costs

Detail	Price in Ugandan Shillings	Price in US\$
Infrastructure investment needed, spread over 5 years	12.1bn	\$3,300,000
Training costs for all staff, spread over 5 years	6.658bn	\$1,750,000
Maintenance and Servicing, spread over five years	2.3bn	\$600,000
Total	21.058bn	\$5,650,000

The nature of the project means the cost of this could be largely spread over the five years of the project, meaning a children's surgical service can be significantly enhanced over the next five years for as little as one point one million USD per annum.

Summary of Implementation Plan and strategy

TARGET AREA	PROPOSED STRATEGY/INTERVENTIONS
HUMAN RESOURCES	<ul style="list-style-type: none"> - 21 paediatric surgeons delivering care in 5 years - 10 paediatric anaesthesia providers - 60 paediatric perioperative nurses - 125 General Hospital staff trained in paediatrics
INFRASTRUCTURE	<ul style="list-style-type: none"> - Paediatric surgery infrastructures at the Super-hub hospital to enable provision of specialist and super specialist care and support to hubs - 10 Paediatric Surgery Operating Rooms at the Hub hospitals
SERVICE DELIVERY	<ul style="list-style-type: none"> - Super hub, hub, spoke model implemented - Developing Referral networks - Embracing point of care medicine
FINANCING	<ul style="list-style-type: none"> - An investment of c.\$5.6M over five years to support training, infrastructure and human resources (not including wage costs)
GOVERNANCE	<ul style="list-style-type: none"> - Annual review and assessment to report to PS on progress.
TRAINING	<ul style="list-style-type: none"> - Specialist, superspecialist and non-surgeon/non-anaesthesia providers - The College of Anaesthesiologists of East, Central, and Southern Africa (CANECSA) and College of Surgeons of East Central and Southern Africa (COSECSA) as a potential for paediatric Anaesthesia and paediatric surgery providers at Membership and Fellowship level - University system for Master of Medicine Specialist programs - Use of virtual learning and global placements - Paediatric anaesthesia fellowship under the WFSA - GICS model utilized for General Hospital staff

NEXT STEPS

We suggest the next steps for this project include;

1. Approval and adoption of the plan by the Ministry of Health
2. Named individuals appointed to oversee:
 - I. Hospital Development – ensure 10 Hub Hospitals are engaged with spaces identified and needs assessments completed to allow investment.
 - II. Paediatric surgical training (ensuring sufficient number of Ugandans come forward for FCS training in Paediatric Surgery to allow 21 surgeons to be actively delivering care across Uganda by the end of 2027)
 - III. Paediatric anaesthesia training (ensuring sufficient number of Ugandans come forward for the paediatric anaesthesiology training to allow 10 to be actively delivering care across Uganda by the end of 2027)
 - IV. Paediatric perioperative nurse training (ensuring sufficient number of Ugandans come forward for the paediatric perioperative nursing training to allow 60 nurses to be actively delivering care across Uganda by the end of 2027)
 - V. Training General hospital staff in paediatric surgery (ensuring sufficient engagement from general hospitals across Uganda to allow 125 staff to have enhanced training in safe provision of paediatric surgery)
 - VI. Maintenance and engineering (ensuring there is an appropriate servicing and maintenance program in place in any hospital that receives an investment in surgical equipment or surgical workforce)
3. This taskforce should re-convene every six months to monitor progress and prepare an annual update to the PS
4. Develop a communication and dissemination strategy for the plan to ensure that the details are known and used for ongoing improvements in children’s surgery across Uganda.

CONCLUSION

This plan depicts areas of need and informed our implementation strategy to improve children's surgery in Uganda. This is an important first step to scaling up existing successes and reaching the ideal level of provision for children's surgical care across the whole country.

The PS's involvement has given the project momentum and it is important that this high-level support be sustained if success is to be achieved. However, this plan is relatively low cost, will build on existing success, can be delivered, will have a significant impact on the healthcare of large numbers of patients and will move Uganda further towards genuine success in delivering quality healthcare for its population.

If supported and funding is secured, work to deliver this plan can begin immediately.



Mulago National Referral Hospital, Uganda

APPENDIX

I. Equipment List

Establishment of Regional Paediatric Surgery Centers in Uganda_Medical Equipment, Medical Furniture Required

Item ID	Description
OT	Core Equipment
OT-01	Operating Table & Accessories
OT-02	Mobile Operating Light- <i>Halogen with Battery Back-up System</i>
OT-03	Anaesthesia Machine (2 Vapors, Monitor 6-parameters, Gas Monitoring & other Accessories) Pediatric, Adult
OT-04	Surgical Instrument, Major Set
OT-05	Surgical Instrument, Minor Set
OT-06	Surgical Instrument, Pediatric Set
OT-07	Surgical Instrument, Thoracotomy Set
OT-08	Surgical Instrument, Supplementary Set
OT-09	Laryngal Surgery Set
OT-10	Laparotomy Set
OT-11	Vascular Set
OT-12	Soft Tissue Set
OT-13	Micro-Laryngoscopy Set
OT-14	HF Unit & Accessories
OT-15	Instrument Serving Table
OT-16	Instrument Cart
OT-17	Large Suction Unit & Accessories
OT-18	Small Suction Unit & Accessories
OT-19	Syringe Pump
OT-20	Infusion Pump
OT-21	X-Ray Film Viewer
OT-22	Sterilizer, Benchtop (21L)
OT-23	Defibrillator, Clinical & Accessories
OT-24	Pulse Oximeter
OT-25	Organ & Tissue Medical Scales
OT-26	Warming Blanket Unit & <i>Radiant Warmer</i>
OT-27	Oxygen Concentrator
OT-28	OR Patient Monitor & Accessories
OT-29	Patient Monitor Accessories Spares Bundle
OT-30	Breathing Accessories & Disposables Bundle
OT-31	Blood & Infusion Warmer
OT-32	<i>Ceiling Mount Operating Light with Halogen</i>
OT-32	<i>UV Sterilizer</i>
FUR-01	Patient Stretcher
FUR-02	Emergency Trolley
FUR-03	Metal Lockable Cabinet
FUR-04	Tall Sack Trolley

FUR-05	Instrument Trolley
FUR-06	Gratnell Storage Trolley
FUR-07	Anaesthetic Trolley
FUR-08	Mayo Trolley
FUR-09	Patient Privacy Screen
FUR-10	Revolving Stool
FUR-11	Cidex Tray
FUR-12	Saline/Drip Stand Bundle
FUR-13	Contamination Tub & Trolley
FUR-14	Kick Basin Bundle
FUR-15	Stainless Steel Bowl & Trays Bundle
FUR-16	Bowl Stand Bundle
FUR-17	Soiled Linen Trolley
FUR-18	Surgeons Step Stool/Foot Stool
FUR-19	Metal Chrome Wire Shelving Unit
FUR-20	<i>Pediatric Patient Beds & Mattress</i>
SS-01	Stethoscope
SS-02	Laryngoscope Set McIntosh
SS-03	Laryngoscope Set Miller
SS-04	Nail Brushes
SS-05	Battery Charger
SS-06	Patient ID Bands
SS-07	Headlight
SS-08	Disposable Sterile Surgical Gown Packs
SS-09	Disposable Blue Aprons
SS-10	Patient Gown
SS-11	Disposable Face Masks Type IIR (50Pcs per Box)
SS-12	Protective Clothing
SS-13	Goggles
SS-14	Partner Scrub Caps
SS-15	Scrubs Bundle
SS-16	Wheel Chairs
SS-17	Garbage Collection Bins
SS-18	Drug/Pharmacy Refrigerator
DOC-01	Office Tables with side drawers, 150X75 cm
DOC-02	Office Chairs
DOC-03	32inch TV Set (Zoom Meeting)
DOC-04	Desk Top Computers
DOC-05	Projector
DOC-06	Internet Connectivity
UT-01	Electricity
UT-02	Generator Fuel or alternative power supply
UT-03	Telecommunications
UT-04	Internet where not available
UT-05	HVAC/Air Conditioner
UT-06	Water where not available
REC-01	<i>Pediatric Beds (Should be manipulated to meet Resuscitation Positions)</i>

REC-02	Patient Blankets
REC-03	Bed Sheet Pair
REC-04	Bedside Cabinet
REC-05	Ventilator (Adult & Pediatric)
REC-06	Patient Monitors (Adult & Pediatric)-5 Parameters (ECG, RESP, TEMP, NIBP, SPOZ)
REC-07	Suction Pump
WT-01	Waiting Bench 3 seater, Metallic
WT-02	Garbage Collection Bin
WT-03	Shoe Rack
STG-01	Shelves
STG-02	Small Ladder to access supplies
SEC-01	Access Control System
SEC-02	Video Intercom where appropriate
SEC-03	CCTV Cameras where appropriate
OTH-01a	Washing & Decontamination Area Equipment
OTH-02b	Instrument Preparation & Packing Area Equipment
OTH-03c	Steam Sterilization Equipment
OTH-04d	Technical Room Equipment
OTH-05e	Sterile Material Store Equipment & Transport of Material
OTH-06f	Generator 200KVA
OTH-07g	Washing Machine for OR
OTH-08h	Pick-ups for Monitoring & Support Supervision
OTH-09i	Work Platform
PED-01	Children Toys
PED-02	Children's Table
PED-03	Children's Chair
CAL-01	Defibrillator Analyzer
CAL-02	Infusion Pump Analyzer
CAL-03	Battery Tester
CAL-04	Ventilator/Anaesthesia Analyzer
CAL-05	NIBP, SPO2, ECG Simulator for Testing Vital Signs/Patient Monitor
CAL-06	Automated Electrical Safety Analyzer
CAL-07	Megger Tester
CAL-08	ESU (Electrosurgical Unit) Analyzer
MCT-01	On-Site Training
MCT-03	Maintenance & Repair Budget (<i>To be planned & Allocated to be used after Warranty Period for a period of at least 2 years</i>)

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