MINISTRY OF HEALTH

NATIONAL IMPLEMENTATION PLAN FOR MEDICAL OXYGEN SCALE UP

2023/24 – 2027/28

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The National Implementation Plan for Medical Oxygen Scale up (2023/24 – 2027/228)

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Foreword

The development of any nation depends largely on the health status of its population. Uganda strives to become a middle-income economy, with the health sector providing high-quality health care for all through Universal Health Coverage (UHC). One of the objectives of the Ministry of Health Strategic plan 2020 – 2025 are to ensure availability of quality and safe medicines, vaccines and technologies as well as improving functionality and adequacy of health infrastructure. Undertaking continuous training and capacity building for health workers, improving maternal, neonatal and child health services at all levels of care, strengthening emergency medical service and referral system and improved capacity for operation and maintenance of medical equipment are among the interventions to ensure increased access to nationally coordinated health services.

Oxygen therapy is vital for addressing hypoxaemia, a condition prevalent in various health issues such as pneumonia, sepsis, malaria, obstructed labour, caesarean sections, birth asphyxia, and more recently, COVID-19. The Government of Uganda is committed to improving hypoxaemia management to facilitate the attainment of its overall objective of delivering high-quality health services to all citizens. This is evidenced by the launch of the first ever 5-year National Implementation Plan for medical oxygen scale up in 2019, substantial financial investments, establishing systems and infrastructure for increasing access to medical oxygen beyond the COVID-19 pandemic. Building upon experiences gained over the previous five years, including lessons from the COVID-19 pandemic, the Ministry of Health has successfully crafted a new National Implementation Plan for Medical Oxygen Scale-up (2023/24-2027/28).

A well designed and functional medical oxygen ecosystem is essential in effectively managing hypoxaemia. The National Implementation Plan for Medical Oxygen Scale-up (2023/24-2027/28) underscores the importance of a holistic approach in enhancing accessibility and availability of medical oxygen therapy services in Uganda.

The National Implementation Plan for Medical Oxygen Scale-up (2023/24-2027/28) will provide strategic guidance on improving equitable access to quality medical oxygen therapy services, hence promoting oxygen security.

I, therefore, call upon all public and private stakeholders to tirelessly contribute towards a successful implementation of the National Implementation Plan for Medical Oxygen Scale-up (2023/24-2027/28).

Hon. Dr. Jane Ruth Aceng Ocero (MP)

MINISTER FOR HEALTH

Preface

The Government of Uganda launched the first ever 5-year National Implementation Plan for medical oxygen scale up in 2019. This strategic plan formed the basis for effective interventions and played a crucial role in the successful response to the COVID-19 pandemic. Notable achievements during the implementation of the plan include the increased production capacity of oxygen, the establishment of a coordination mechanism, the introduction of a medical equipment inventory management system, the integration of pulse oximetry into the triage process in one out of every four health facilities, and a commitment of over US$20 million in funding from the government and partners for the expansion of medical oxygen services.

Upon the expiration of the initial National Implementation plan for Medical Oxygen Scale-up (2018-2022), the Ministry of health together with a consortium of partners placed a significant emphasis on evaluating and reviewing the plan. This involved developing a new plan reflecting on the lessons learned from the challenges posed by the COVID-19 pandemic and the implementation efforts undertaken over the preceding five years. The National Implementation plan for Medical Oxygen Scale-up (2023/24-2027/28) will continue to act as a guide and blueprint for the Ministry of Health and partners to improve access to medical oxygen and contribute to a reduction in hypoxaemia-related deaths suffered annually.

The purpose of this plan is to consolidate the progress achieved over the past five years and establish sustainable systems that enhance oxygen programming for more effective outcomes in alignment with the National Health Strategy. Specifically, the plan aims to reduce mortality and morbidity associated with hypoxaemia through five key objectives: (i) to strengthen hypoxaemia diagnosis, management and improve oxygen utilization; (ii) to strengthen medical oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels; (iii) to strengthen coordination and management of the medical oxygen systems at national, district and health facility levels; (iv) to strengthen routine medical oxygen data collection and management information systems for surveillance of hypoxaemia and medical oxygen access; (v) to mobilize resources for strengthening medical oxygen systems at national, district and health facility levels.

The plan underscores the importance of ensuring medical oxygen security, outlining the strategies to attain this goal. These include establishing a National Oxygen sub-committee (NOC), expanding oxygen production capacity, optimizing equipment functionality, promoting public private partnerships, improving oxygen supply chain coordination and accountability, improving oxygen inventory management, increasing access and availability of medical oxygen and prioritizing oxygen for funding under general health budget.

Achieving the set targets in the plan necessitates a coordinated effort between the public and private sectors, addressing every aspect outlined in the plan through collaboration with the National Oxygen sub-committee at both the subnational and national levels.

It is hoped that the National plan for scaling up access to medical oxygen in Uganda will guide safe delivery and rational use of medical oxygen across all levels of the health care delivery system and contribute to reduction of morbidity, disability and mortality.

Therefore, I call upon all stakeholders to unite their efforts in mobilizing the necessary resources required for scale up of medical oxygen to increase access and availability of medical oxygen to all patients with hypoxaemia

For God and my Country,

Kenneth Akiiri
FOR PERMANENT SECRETARY

Acknowledgment

The National Implementation Plan for Medical Oxygen Scale up 2023/24-2027/28 is a result of joint efforts of the Ministry of Health, Development and Implementing partners, and Civil Society Organizations.

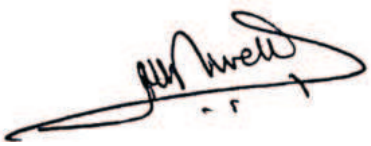
The Ministry of Health wishes to acknowledge the contributions of various organizations that supported the process, both financially and technically. Appreciation goes to those individuals who took part in reviewing the earlier editions and whose tireless efforts produced the final document for approval.

We hereby commend all Ministry of Health Directorates and Departments; the District Health Teams and health facilities who cooperated extensively to make sure the review and update of the National Implementation Plan for Medical Oxygen Scale up occurred comprehensively and ensured that the final policy document is in line with national and international policies.

We also extend sincere gratitude to all the United Nations agencies, particularly United Nations Children's Fund (UNICEF), international and national Non-Governmental Organizations, especially the Clinton Health Access Initiative (CHAI), PATH, FREO2, FHI360, Management Sciences for Health (MSH) and Strengthening Supply Chain Systems Activity (SSCS) for their support in reviewing, revising and updating the National Implementation Plan for Medical Oxygen Scale up. The Ministry of Health acknowledges the technical assistance, guidance and constructive comments provided by all stakeholders during the revision process.

The commitment of all these stakeholders to strengthening the oxygen ecosystem is greatly appreciated, as it contributes significantly to improving hypoxaemia management and ensuring the availability of medical oxygen across Uganda.

The Ministry of Health commits to the overall stewardship of this strategy through communication and dissemination, implementation, periodic monitoring and planned evaluations to assess and document successes, enablers and challenges.



Dr. Henry Mwebesa
Director General Health Services

List of Abbreviations and Acronyms

AAU	Association of Anaesthesiologists of Uganda
ADHO	Assistant District Health Officer
APSPR	Annual Pharmaceutical Sector Performance Report
BMET	Biomedical Engineers and Technicians
CAO	Chief Administrative Officer
CHAI	Clinton Health Access Initiative
CPAP	Continuous Positive Airway Pressure
CPHD	Center for Public Health and Development
CSD	Clinical Services Department
CSO	Civil Society Organization
CTU	COVID-19 Treatment Unit
DGHS	Director General of Health Services
DHI	Division of Health Information
DHIS2	District Health Information Software
DHO	District Health Officer
DLoFP	District Logistics Focal Person
DMMS	District Medicines Management Supervisor
DNMW	Department of Nursing and Midwifery Services
DPFP	Department of Planning, Financing and Policy
DPNM	Department of Pharmaceuticals and Natural Medicines
e ELMIS	electronic Emergency Logistics Management Information System
ECCOR	Extracorporeal Carbon Dioxide Removal
ECMO	Extracorporeal Membrane Oxygenation
EMHSL	Essential Medicines and Health Supplies List
EMS	Emergency Medical Services
ERA	Electricity Regulatory Authority
GF	Global Fund
GGG	Global Gases Group
GH	General Hospital
GOU	Government of Uganda
HEPD	Health Education and Promotion Division
HID	Health Infrastructure Division
HMIS	Health Management Information System
HPAC	Health Policy Advisory Committee
ICU	Intensive Care Unit
IMT	Incident Management Team
IP	Implementing Partner
IPC	Infection Prevention and Control

JMS	Joint Medical Stores
LMD	Last Mile Distribution
LMIS	Logistics Management Information System
LOC	Level of Care
LOX	Liquid Oxygen
LPM	Liters Per Minute
MCH	Maternal and Child Health
MEMD	Ministry of Energy and Mineral Development
MNRH	Mulago National Referral Hospital
MOES	Ministry of Education and Sports
MOFPED	Ministry of Finance, Planning and Economic Development
MOH	Ministry of Health
MSH	Management Sciences for Health
MTC	Medicines and Therapeutic Committee
NACME	National Advisory Committee on Medical Equipment
NDA	National Drug Authority
NDP	National Development Plan
NICU	Neonatal Intensive Care Unit
NMCD	National Malaria Control Division
NMS	National Medical Stores
NOC	National Oxygen Committee
NOMAD	The New Order for Managing Anything Data
NPSSP	National Pharmaceutical Services Strategic Plan
NRH	National Referral Hospital
OPRMS	Oxygen Plant Remote Monitoring System
PFP	Private for Profit
PHE	Public Health Emergency
PHEOC	Public Health Emergency Operations Center
PNFP	Private not for Profit
PPM	Planned Preventive Maintenance
PSA	Pressure Swing Adsorption
QA	Quality Assurance
RRH	Regional Referral Hospital
SB	Silverbacks
SCAPP	Standards, Compliance, Accreditation and Patient Protection
SH	Specialized Hospitals
SOP	Standard Operating Procedure
SSCS	Strengthening Supply Chain Systems
TBD	To be determined
TOT	Training of Trainers

UCI	Uganda Cancer Institute
UCREPP	The Uganda COVID-19 Response and Emergency Preparedness Project
UHC	Universal Health Coverage
UHF	Uganda Health Federation
UHI	Uganda Heart Institute
UNBS	Uganda National Bureau of Standards
UNHRO	Uganda National Health Research Organization
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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Background

1.1 Introduction

The implementation plan Medical Oxygen Scale up 2023/24 – 2027/28 summarizes the commitments and priorities of Uganda Ministry of Health and it replaces the previous National Medical Oxygen Scale-up Plan 2018-2022. It proposes at strategic level Uganda Ministry of Health's aspirations to strengthen the medical oxygen system consisting of appropriate and functional oxygen equipment, trained biomedical engineers and health workers and an oxygen supply chain that promotes adequate access of medical oxygen to those who need it. This implementation is aligned with other relevant government plans as follows. It emphasizes the priorities of the National Development Plan 2020/21 – 2024/25 which has priorities to strengthen human capital for social services including health and to promote local manufacturing. Other relevant projects described in the NDP relevant to this plan are digital transformation that includes increased ICT penetration and digitalization of government business. More importantly, this implementation plan is in alignment with the Ministry of Health Strategic Plan 2020/21 – 2024/25, the National Pharmaceutical Services Strategic Plan 2020/21 – 2024/25, the National Medical Equipment Guidelines 2020/21 – 2024/25, the health infrastructural development plan 2020/21 – 2024/25 and all relevant plans as it emphasizes key interventions with regard to medical oxygen systems in the areas of governance, management and coordination, human resource capacity development, adequate access of safe and quality medicines and health technologies, functional and appropriate health infrastructure and logistical capacity. This implementation plan reiterates the centrality of Sustainable Development Goal 3.8 "*access to safe, effective, quality and affordable essential health commodities for all*" to the achievement of Universal Health Coverage (UHC), and the emphasis of medical oxygen as an essential medicine has been further expounded in the *draft member states' resolution to increase access to medical oxygen*.

1.2 Importance of reliable medical oxygen systems

Low oxygen levels in blood, also referred to as hypoxaemia, occurs in many acute and chronic disease conditions across the life course and contributes to their severity and mortality. Hypoxaemia affects patients of all ages, sex, aetiology and geographical region. Medical oxygen is a life-saving essential medicine that has no substitute and remains out of reach for many hypoxemic patients. The COVID-19 pandemic demonstrated the inadequate affordability and sustainability of medical oxygen nationally where the inordinately large clinical demands at hospitals exceeded available oxygen supply, resulting in preventable deaths. Oxygen in the market is available for industrial and medicinal use. Industrial oxygen may contain impurities and harmful contaminants and should not be inhaled as medicinal oxygen.

1.3 The Medical Oxygen Ecosystem in Uganda

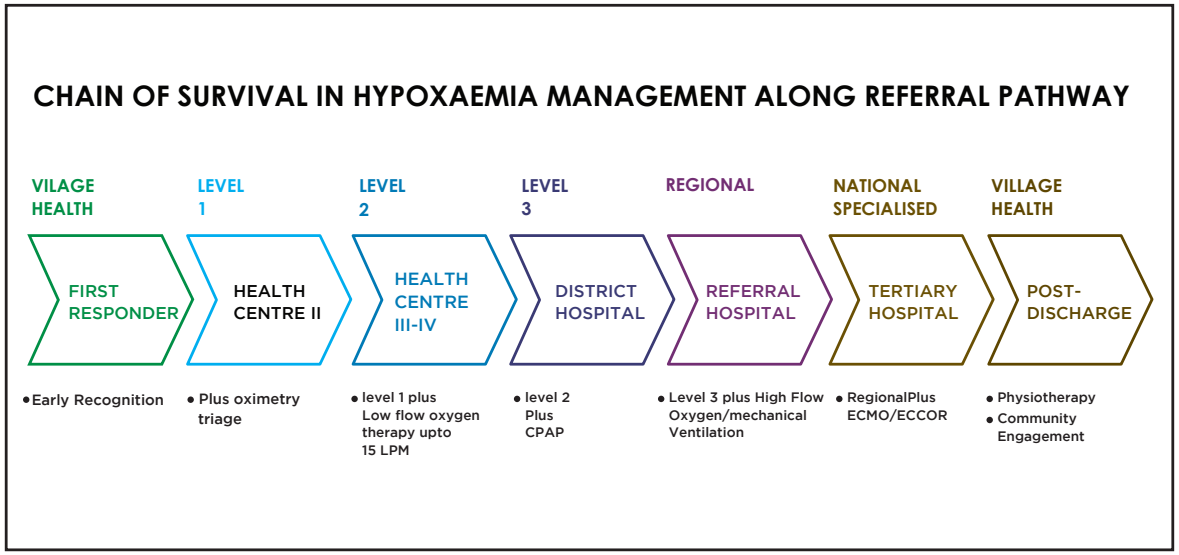
The Ugandan medical oxygen system mirrors the pluralistic character of the health system where *commercialized provision of health commodities and services co-exist with free or low-cost care in the public sector*. Over the last five years, the Government of Uganda has strengthened coordination and stewardship and there is a substantial contribution of non-state actors including private sector oxygen production firms in the different aspects of medical oxygen

systems. Strengthening medical oxygen systems in Uganda, like elsewhere, has gained more focus recently following the COVID19 pandemic and implementation of the first national scale-up implementation for medical oxygen 2018 – 2022. As such, efforts to streamline its coordination at all levels and integrate into the national back-bone health commodity supply chain led by the National Medical Stores have gained traction and remain important priorities going forward.

1.3.1 Service Provision

The current medical oxygen system is intended to service the chain of survival in hypoxaemia management along the referral pathway illustrated in the figure below.

Figure 1: Hypoxaemia Management Referral Pathway



1.3.2 Supply Chain Management

In Uganda, Medical Oxygen is produced in 4 major ways:

1- Pressure Swing Adsorption (PSA) plants,
2- Oxygen Concentrators,
3- Liquid Oxygen (LOX) tanks, and
4- Mixed systems combining some of the above production techniques.

Delivery of Oxygen for patient administration is done using cylinders (bedside/manifold) filled by any of the above sources, by on-demand production during administration (i.e. concentrators), or direct piping to the patient's bedside from PSA plants/LOX tanks.
Oxygen in Uganda is distributed through a mix of ways across the public and private health sectors as shown in the table below:

Table 1: Medical oxygen Supply Chain

Sector	Suppliers	Recipients	Supply mode	Delivery Mechanism
Public	NMS (Sourced internally/private suppliers)	All health facilities	Pull system – RRHs/NRHs Push system – GHs & Lower facilities	Cylinders
	Hospitals (RRHs/NRHs/GHs)	- Internal consumption - GHs & lower facilities	Requisitions and issue vouchers	- Cylinders (bedside/manifold system for RRHs) - Direct piping in NRHs - Bedside cylinders for GH/Lower facilities
	Private Suppliers	Some RRHs and GHs	Private arrangement	Cylinders
PNFP	JMS	Most PNFPs	Pull system	Cylinders
		Selected High Volume PNFPs	Plant Placement Model	- Direct piping - Cylinder (bedside/manifold)
	Private Suppliers	Some PNFPS	Private arrangement	Cylinders
Private	Private Suppliers	Some PFPS	Private arrangement	Cylinders

Uganda's Oxygen logistics and supply chain management faces a few challenges including but not limited to the following:

- Lack of quality data and reliable logistics records to support accurate quantification, forecasting, data-driven supply planning and commodity accountability.
- Generalized absence of robust storage infrastructure for Oxygen cylinders in health facilities leading to gross damages and contamination of stored Oxygen and cylinders
- Weak coordination framework for the country's Oxygen supply chain system – with unclear roles and responsibilities, low technical/institutional capacity, no order management systems, and poorly funded management activities
- Lack of funds for procurement of Oxygen supplies needed for proper patient care by health facilities.
- High proportion of non-functional Oxygen therapy and production equipment (including PSA plants) that are not regularly serviced/maintained due to very low maintenance budgets and sharp shortage of competent biomedical engineers/technicians.

To effectively ensure oxygen supply to all levels of care, it is critical to consider a revised supply mix as illustrated below.

Table 2: Medical oxygen supply mix

SUPPLY TO THE FACILITY			SUPPLY TO THE PATIENT				
Site	Primary	Secondary /backup	LOC	Piping		Cylinders	Concentrators
				Direct from plant	Manifold		
SH (UCI, UHI & Women's Hospital)	PSA Plant (100%)	NMS	**SH**	20%	50%	20%	10%
MNRH	PSA Plant (100%)	LOX	**MNRH**	50%	10%	30%	10%
Other NRHs (Kiruddu, Kawempe,Butabika)	PSA Plant (100%)	NMS	**Other NRHs**	80%	10%	5%	5%
RRHs	PSA Plant (100%)	NMS	**RRHs**	10%	60%	20%	10%
Lower-Level Health Facilities (GHs, HCIVs, HCIII)	RHHs/NMS	Private Suppliers	**GHs**	0%	40%	40%	20%
			HCIVs	0%	10%	50%	40%
			HCIIIs	0%	0%	20%	80%

Assumptions and justification

- Consumption rates (in consideration of the highest consuming wards)
- Patient care services
- Cost of the investments and maintenance
- Cost and ease of distribution
- Availability and stability of power
- Human resource and technical capacity
- Hospital infrastructure

1.3.3 Human Resources

For a well-functioning medical Oxygen system in the country various cadres are needed to manage various critical components as listed below:

Table 3: Medical Oxygen Healthcare workforce

Domain	Cadre types needed	Current capacity
National and subnational level coordination and stewardship	National oxygen sub-committee with representation from all relevant stakeholders such as: Clinical services, Pharmacy, HID, EMS, PHE, MCH, DHI, NMS, JMS, UHF, Partners, etc with dedicated chairperson(s) at the level of Assistant Commissioner above.	National Oxygen Taskforce is in place *(needs to be transitioned into a permanent committee)* Currently chaired by the ACHS-SCAPP & co-chaired by ACHS-PSCL
	Secretariat for the National Oxygen sub-committee the following key officers: -Oxygen Ecosystem Coordination Desk Officer (Clinical Services Department) -Operations/QA coordinator - Supply chain coordinator -Hypoxaemia management coordinator - Administrative officer	1 Oxygen Ecosystem Coordination Desk Officer 1 Operations/QA coordinator 1 Supply chain coordinator 1 Hypoxaemia management coordinator 1 Biomedical Engineer
	Regional & district level focal persons for hypoxaemia management, logistics management, and reporting/data use	(Need for integration at regional/district level)
Hypoxaemia Diagnosis & Management	General Doctors & Nurses (capacitated via refresher training)	1,041
	Anesthesiologists and critical nurses	
	Consultants for Critical Care, Paediatric Care, Surgery, Maternal/Neonatal Care & Respiratory Care.	Vary according to discipline
Oxygen Supply Chain	Pharmacists, Dispensers, Inventory Officers & Biomedical engineers	480

Domain	Cadre types needed	Current capacity
Management	(capacitated through refresher training)	
Oxygen Production & Maintenance management of Oxygen Equipment	Production technicians (specially certified for either PSA/LOX plants)	20
	Biomedical engineers/ technicians (capacitated through refresher trainings)	123
Quality Assurance and Administrative Management	M&E and Data Management Officers (capacitated through refresher training)	Biostatisticians 58 Health Information Assistants 104 MOH DHI Staff 5

1.4 Process of developing the implementation plan for scale-up of medical oxygen

This plan has been developed by the Ministry of Health with input from several experts/ technical officers in the areas of hypoxaemia diagnosis and management, pharmaceuticals and oxygen supply systems, biomedical engineering, coordination and governance and data management systems.

The development process of the implementation plan for scale-up of medical oxygen was initiated by the directorate of curative services, Ministry of Health. It was triggered by the coming to an end of the national medical oxygen scale-up 2018 – 2022 and the urgent need to prioritize its evaluation and review, reflecting on the lessons learnt from the COVID-19 pandemic and the various implementation efforts over the past five years. A consultant was onboarded for the evaluation of the national medical oxygen scaleup plan 2018-2022 led by the Oxygen Task Force and subsequent development of a new plan. The evaluation process started with a desk review of the Monitoring and Evaluation framework of the National Oxygen scaleup plan 2018-2022 and existing policies and guidelines on oxygen equipment, and consumables and then followed by a field evaluation. An evaluation tool was thematically developed using specific objectives, pre-tested and rolled out in 85 selected health facilities ranging from NRHs, RRHs, GHs, HCIVs to Private Not for Profit Hospitals (PNFPs) across the country.

Results from the evaluation were presented to the Clinical Care& Infrastructure Technical Working Group and disseminated in a national stakeholder engagement meeting.

A consultative process with stakeholders and experts in the Uganda oxygen space at both national and sub-national level was used to identify thematic areas for structure of the new scale up implementation plan. Two writing workshops were subsequently held and this technical working Group – an interdisciplinary group of expert pharmacists, clinicians, biomedical engineers, data officers, administrators etc.– provided input on early drafts of the chapters of this scale-up plan. A draft- review team, with representation from stakeholder organizations working in the field of hypoxaemia diagnosis and management, oxygen supply systems,

including CHAI, PATH, UNICEF, Lancet Global Health Commission on Medical Oxygen Security, academia and others, provided technical advice on the plan and had the opportunity to comment on later drafts of the technical interventions and activities and the plan structure. An editorial team representative of the DPNM, HID, Clinical services, EMS, DHI was constituted.

Following the approval roadmap, the draft was presented to the MOH Clinical care and Infrastructure Technical Working Group, reviewed and recommended for presentation to the Senior Management Committee for approval and escalation to Health Policy Advisory Committee (HPAC) and Top management.

Figure 2: Director Curative Services (Dr. C Olaro) delivering opening remarks at the Oxygen Scale up plan writing workshop

Figure 3: Professor A. Kwizera, the consultant providing guidance to stakeholders during the Scale up plan writing workshop.

2.0 Situational Analysis

2.1 Performance review of the previous (National medical oxygen scale-up implementation plan 2018 - 2022) plan.

Since the inception of the scale up plan, some steps have been made towards meeting initially set targets. The data has been collated from desk, policy, and field reviews. Major updates to targets were informed by a recent MOH field evaluation of 85 facilities conducted in 2022. The table below provides a summary of the implementation progress of the National medical oxygen scale-up implementation plan (2018 - 2022).

Table 4: Overview of progress made

Objective	Indicator	Target	Baseline (2018)	Endline (2022)	Data Source
Policy basis and decision support for oxygen supply	Coordinating mechanisms established	Established	NA	Established	Policy review
	National database of oxygen equipment inventory established	Established	NA	Established	Database review
Maintenance and supply of equipment	% of HCIV/hospitals with recommended number of functional cylinders and concentrators	100%	NA	Cylinders: 65% Concentrators: 51%	2022 Field evaluation report
	% of national and regional referral facilities with a self-contained oxygen plant consistently operating to meet facility demand	100%	90%	58% of the plants were functional at the time the scale up plan evaluation assessment was done	2022 evaluation report
	# of additional distribution vehicles procured or outsourced in the past year	5	0	5	Records/audit

Objective	Indicator	Target	Baseline (2018)	Endline (2022)	Data Source
	% of HCIV/hospitals with at least one functional cylinder or concentrator in each of the following key wards: paediatric, maternity and theatre	100%	NA	50%	2022 evaluation report
	% of HCIV/hospitals with at least one functioning pulse oximeter in each of the following key wards: paediatric, maternity and theatre	100%	NA	23%	2022 evaluation report
	% of HCIV/hospitals with a sufficient supply of spare parts	90%	30%	Data not available	Database of oxygen supply and equipment
Staff training	Training resources and guidelines updated (clinical, biomedical)	Completed	NA	Completed	Records/audit
	% of relevant staff in HCIV/hospitals (nationwide) who have received general/refresher trainings on oxygen therapy and diagnosis in the past year	80%	NA	8%	2022 evaluation report
	Number of new maintenance personnel trained in the past year.	100	0	100	Database of trainees

Objective	Indicator	Target	Baseline	Endline	Data Source
			(2018)	(2022)	
Service Provision	% of patients in HCIV/hospitals OPD who get a pulse oximetry reading	TBD	NA	25% of the health facilities had pulse oximetry included in the triage process at all entry points	2022 evaluation report
	% of hypoxemic patients in HCIV/hospital treated with oxygen	TBD	NA	3%	2022 evaluation report
Funding	Government funding committed to scale up oxygen supply	20Bn	6Bn	>70Bn	Budget review
	% of overall cost to scale up oxygen supply contributed by partners	30%	NA	>30%	Budget review

2.1.1 Objective-based performance review

Objective 1: To provide a national strategic framework to guide scale up of oxygen supply and utilization.

The national oxygen scale-up plan is housed under the Clinical and Health Infrastructure Technical Working Group, however there is no dedicated team to oversee implementation of the plan. At the subnational level, there is no clear ownership of the oxygen supply chain ecosystem. Medical oxygen is on the Essential Medicines and Health Supplies (EMHS) list and is now integrated into existing structures and processes for management of essential medicines.

During the COVID-19 pandemic, an Oxygen Task Force was established to oversee the general operation and management of the oxygen supply chain. Membership was drawn from the Ministry of Health Clinical Services, Health Infrastructure, Pharmacy, and Health Information departments, the private sector, and partners in Health. The oxygen task force was instrumental in availing oxygen to hospitals during the pandemic and continued to strengthen oxygen systems beyond the pandemic, in accordance with the national scale-up plan.

The national medical equipment inventory information system was upgraded and integrated with DHIS2; the rollout of this system has commenced with training of regional medical equipment workshop managers but is yet to be fully implemented nationally.

Hypoxaemia and oxygen stock management indicators were developed and piloted and have been successfully incorporated into the HMIS Monthly Reporting Tool as an addendum, which is captured in DHIS2. National rollout of the addendum is ongoing.

There is not yet a formalized system to track oxygen supply and access at the national or sub-national level.

Objective 2: To secure maintenance and replacement of oxygen therapy and diagnostic equipment through the regional workshops and the National Medical Store

Medical Oxygen Equipment

The National Medical Equipment Policy was revised to include detailed specifications for oxygen equipment and updated recommendations from the National Advisory Committee on Medical Equipment (NACME) on minimum quantities of equipment for the different levels of the health sector.

Only 40%, 51% and 65% of healthcare facilities have the minimum recommended number of pulse oximeters, concentrators and cylinders respectively. Between 2019 and 2022, the total number of pulse oximeters and concentrators at facilities increased by a factor of four, there was an eight-fold increase in the number of oxygen cylinders. This was largely due to COVID investments and N/RRHs were the greatest beneficiaries. As a result of the recent oxygen equipment procurements, over 90% of the available oxygen equipment is functional.

The number of ABG analyzers increased by a factor of 28. However, the ABG machines are not in use, due to lack of human resources and/or consumables. The number of CPAP devices increased significantly from 3 in 2019 to 73 in 2022. Most of these are at RRHs and are currently non-functional for lack of human resources. Again, most of the high flow oxygen equipment—which rose from 6 in 2019 to 82 in 2022, is at RRHs. At RRHs, there are now 117 mechanical

ventilators, up from 18 previously. However, only 3 Intensive care units are fully functional, at Jinja, Mbarara and Kabale RRHs.

Wall outlets for piped oxygen rose from 164 to 1684 and there are operational manifold systems at approximately 3% of HCIVs, 59% of GHs, and 86% of RRHs.

Only 43% of RRHs had regional workshop budgets for spare parts for oxygen equipment, while 70% of facilities performed quarterly regional workshop maintenance and repairs of equipment at their catchment facilities.

During the COVID-19 pandemic the government recruited dedicated personnel to operate the oxygen plants, however few plant operators were retained beyond the pandemic. The plant operator cadre has been incorporated into the RRH staffing structure.

Training modules for the repair and maintenance of various oxygen equipment were developed and used to train 78% of biomedical engineers and 61% of biomedical technicians on oxygen equipment repair and maintenance, and 53% of plant operators on PSA plants and other oxygen equipment.

Medical Oxygen Supply

Only 25% of the store's personnel were trained in oxygen logistics or inventory control in the previous year.

All regional referral hospitals have a self-contained PSA plant, however only 58% of the plants are operational consistently and 65% of RRH plants refill for health establishments in the catchment region.

Although supply frequency varies, lower-level facilities receive supplies less frequently than once per month.

In response to the COVID-19 pandemic, the government invested in 18 PSA plants (100Nm3/hr) and 2 Cryogenic liquid oxygen storage tanks. An additional 4 PSA plants (100Nm3/hr) and 4 PSA plants (30Nm3/hr) were procured with support from partners.

The Uganda National Bureau of Standards (UNBS) in collaboration with National Drug Authority (NDA), updated the standard for medical oxygen in accordance with World Health Organization (WHO) guidance. This will help to promote standardization, safety, and quality of medical oxygen in Uganda.

Objective 3: To provide a framework for training of staff in health facilities on rational use of oxygen and basic maintenance of equipment.

During the previous implementation period, training materials on hypoxaemia management were developed and were successfully incorporated into the Uganda National Clinical Guidelines.

Hypoxaemia management training was conducted at N/RRHs as part of the COVID-19 response, additionally hypoxaemia management training was conducted by partners in specific regions (refer to Annex A: Partner mapping). Despite this, only 7%, 9% and 11% of nurses, midwives and clinical officers respectively received training on hypoxaemia management, which is far short of the 80% target.

Screening for hypoxaemia using pulse oximetry varies across the different wards and

departments, ranging from 14% in maternity units to 73% in neonatal units. Only 25% of healthcare facilities used pulse oximetry as part of the triage procedure at entrance points. Administration of oxygen for patients with hypoxaemia ranged from 86% in paediatric ward to 100% in neonatal unit and operating theatre. 91% of facilities report the routine re-use of nasal prongs designed for single use. Overall, hypoxaemia screening and oxygen administration performance is highest at N/RRHs.

Objective 4: To provide an advocacy instrument to secure funding to support oxygen scale up Interventions

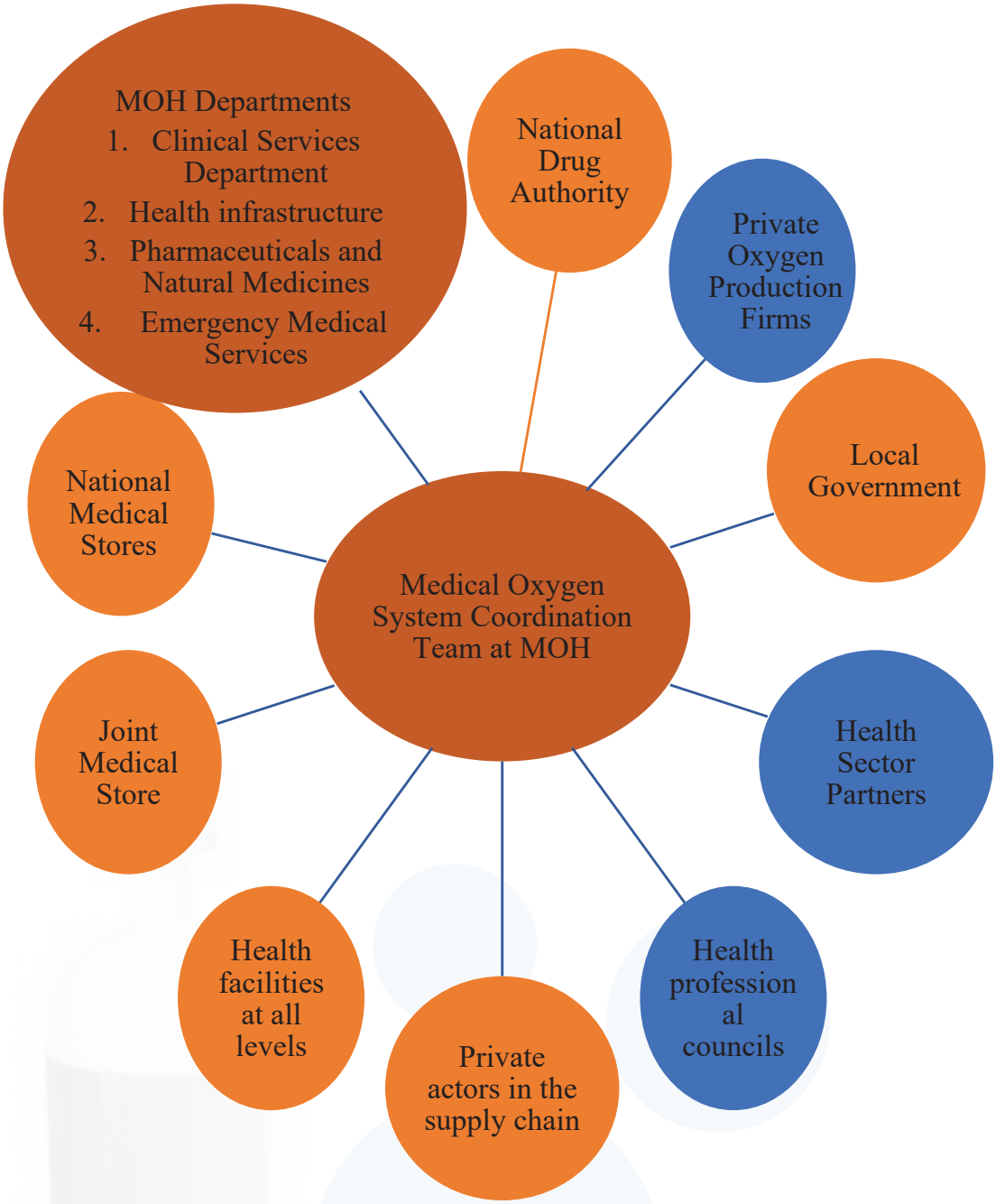
For the fiscal year 2022–2023, 51% of facilities budgeted for medical oxygen services, the average budget was UGX 947,000 (for HCIVs), UGX 23,000,000 (for GHs), and UGX 38,600,000 (for RRHs). Capacity building and cylinder refills from NMS received top priority. There was no transparently described budgeting process.

In response to the COVID-19 pandemic, the government of Uganda invested over UGX 70Bn in oxygen equipment. Approximately UGX 50Bn was secured from the Global Fund for AIDS, Tuberculosis, and Malaria COVID-19 Response Mechanism. Several other partners also made in-kind donations of oxygen equipment.

The Government of Uganda submitted a World Health assembly resolution on increasing access to medical oxygen, which was accepted and will be presented at the 76th World Health Assembly in May 2023.

2.2 Stakeholder analysis – medical oxygen system in Uganda

Figure 4: Institutions and actors relevant to the Medical Oxygen Ecosystem in Uganda



2.3 Regulatory and policy framework for medical oxygen systems

Table 5: Legislations, policies and plans relevant to the medical oxygen systems in Uganda

#	Legislation	Description	Specific reference to medical oxygen systems
1	National Medical Stores Act 1993	Establishes the National Medical Stores (NMS) in the interest of national and public benefit, to ensure the efficient and economical procurement, storage, distribution and supply of quality medicines and medical supplies and establish and maintain such pharmaceutical supply systems. Also estimate the current and future needs as the basis for procurement planning and budgeting for the country.	NMS anchors the national health commodity supply and receives direct funding from the Ministry of Finance, Planning and Economic Development for the public sector. It 2 currently expanding its profile and capacity to meet the country's demand for a streamlined and strengthened medical oxygen supply chain.
2	National Drug Authority Act, 1993	Established the NDA as the national drug regulatory body to ensure the availability, at all times, of essential, efficacious and cost-effective drugs to the entire population of Uganda as a means of providing satisfactory healthcare and safeguarding the appropriate use of drugs.	NDA has the mandate to ensure quality assured medical oxygen is available to Uganda's populace. Efforts to strengthen its capacity to ensure quality assurance mechanisms and standards for medical oxygen along the supply chain are available and implemented.
3	National Drug Authority (Certificate of Suitability of Premises) & (Issue of Licenses) Regulations , 1995	Describes the requirements for the issue of the certificate, which is a pre-requirement for obtaining an operating license. Details requirements for licensing the various types of operations within the pharmaceutical sector.	Sets the basis for NDA to conduct current good manufacturing practices for medical oxygen and its safe handling along the supply chain.
4	National Health Policy 2010	Goal is to attain a good standard of health for all people in Uganda in order to promote healthy and productive lives.	Oversight and leadership for one of the policy objectives "ensuring that essential, efficacious, safe, good quality and affordable medicines and health supplies are available and used rationally at all times in Uganda".
5	National Medicine Policy 2015	Goal is to contribute to the attainment of the highest standard of health for the population of Uganda,	Implementing the National Medicine Policy is a primary mandate of DPNM.

#	Legislation	Description	Specific reference to medical oxygen systems
		by ensuring the availability, accessibility, affordability and appropriate use of essential medicines of appropriate quality, safety and efficacy at all times.	
	Ministry of Health Governance and Management structures Implementation guidelines 2022	The purpose of the guidelines is to strengthen the operations of the MOH governance and management structures. The guidelines provide the framework and guide for the operationalization of the MOH governance and management structures. Specifically, they describe the different governance and management structures of the MOH, define the tasks, responsibilities, and membership of the governance and management structures of the MOH and describe the monitoring and evaluation of the governance and management structures of the MOH.	Medical Oxygen Systems are a vital and health systems issue. To move from the approach of implementing in silos, the MOH has prioritized coordination and stewardship across relevant departments at MOH and units in health facilities, respectively as critical to strengthening medical oxygen systems. The implementation guidelines for MOH governance and management structure provide the framework for this coordination.
	National Pharmaceutical Services Strategic Plan 2020/21 – 2024/25	The overall goal of the NPSSP IV (2020-2025) in line with the National Medicines Policy is to contribute to the attainment of the highest standard of health for the population of Uganda, by ensuring the availability, accessibility, affordability and appropriate use of essential health commodities and pharmaceutical services of appropriate quality, safety and efficacy at all times.	It prioritizes key intervention relevant to the Medical Oxygen scale up plan including To improve stewardship and coordination for pharmaceutical service delivery, and strengthen the health commodity supply management system, the human resource capacity for pharmaceutical sector, the pharmaceutical sector regulations and compliance, appropriate use of medical products, local pharmaceutical manufacturing, sustainable financing and pricing mechanisms, and pharmaceutical information management systems in Uganda.
6	National Medical Counter Measures Supply Chain Plan	Goal is to provide an operational framework to coordinate the forecasting, quantification, procurement, storage, and deployment of medicines and health supplies and medical assets in	Oversee the implementation of the National Medical Counter Measures Supply Chain Plan including the emergency electronic LMIS and availability of priority medical counter measures including medical oxygen.

#	Legislation	Description	Specific reference to medical oxygen systems
		response to public health emergency threats.	
7	The Uganda Health Information and Digital Health Strategic Plan 2020/21 – 2024/25	Goal is to ensure availability of vital health information to strengthen data driven decision making across all sectors including health.	Decision making in the pharmaceutical sector including for medical oxygen systems is dependent on availability of timely, reliable comprehensive data about health commodities, patients and target populations. The directorate of clinical services where medical oxygen systems are a cross-cutting issues and other stakeholders rely on several management information systems and technologies to collect, store, manage, analyze, report and retrieve data and information for decision making.
8	National Scale-up of Medical Oxygen Implement ation Plan 2019	Goal is to increase the availability and utilization of oxygen in higher level facilities by providing a national strategic framework, maintenance and replacement of oxygen delivery systems, diagnostic equipment and oxygen production systems, training of health workers and resource mobilization.	Oversee and manage the supply chain system of medical oxygen, pulse oximeters, equipment, health commodities needed for oxygen production and delivery and appropriate oxygen therapy.
9	Uganda Clinical Guidelines	Aims to provide summarized easy-to-use, practical, complete and useful information on how to quickly and correctly diagnose and manage common conditions you are likely to encounter. To ensure that patients receive the best possible clinical services and obtain prompt and effective relief from or cure of their complaint, thereby making the most appropriate use of scarce diagnostic and clinical resources, including medicines	Oversight on hypoxaemia management and oxygen therapy Guidelines.
10	Essential Medicines and Health	Goal is to ensure the availability of safe, effective, and affordable essential medicines and supplies that address the population's health	Medical oxygen is classified as an essential medicine and a vital commodity. The list emphasizes the

#	Legislation	Description	Specific reference to medical oxygen systems
	Supplies List of Uganda	needs. It guides healthcare providers in selecting and prescribing appropriate medicines, promoting rational use, cost-efficiency, and equitable access. Also aims to improve healthcare quality by standardizing essential health products across all levels of the healthcare system, from national hospitals to community health centers.	need for its availability from Health Center Ivs to national hospitals.
11	Uganda Essential Medicines and Health Supplies Management Manual	The manual provides guidance to healthcare workers and managers in effectively managing essential medicines and health supplies across all levels of the healthcare system. It aims to ensure the continuous availability, proper storage, distribution, and rational use of medicines and health supplies. It seeks to improve access to quality healthcare by providing standardized procedures and best practices for inventory management, procurement, reporting, and monitoring of health commodities.	Management of medical oxygen and related supplies including distribution, proper storage, appropriate use of medical oxygen, quality improvement and performance management.
12	National Medical Equipment Guidelines 2023	The goal is to ensure that medical equipment acquisition and its management is efficient, cost effective and sustainable. These guidelines look at the whole medical equipment procurement and management lifecycle from purchase, use, decommissioning, replacement and disposal.	Management of medical oxygen equipment, including pulse oximeters, concentrators, and cylinders, including the prescription of minimum quantities for each level of care.

3.0 Implementation plan for scale-up of medical oxygen (FY 2023/24-2027/28)

3.1 Goal/Aim

The National Strategy for the Scale-up of Medical Oxygen in Uganda aims to reduce mortality and morbidity from all cause hypoxaemia by addressing gaps that lead to inadequate access to medical oxygen. Specifically, this national implementation Strategy will increase access to oxygen supply systems over the next five years by creating an enabling environment for management of hypoxaemia; improving availability of high-quality diagnostics and oxygen supply systems; improving clinical use of oxygen and maintenance of equipment by healthcare teams; improving coordination mechanisms and sustainable financing as well strengthen collection, management, and use of high-quality data for hypoxaemia management.

3.2 Objectives:

1. To strengthen hypoxaemia diagnosis, management and improve oxygen utilization.
2. To strengthen medical oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels.
3. To strengthen coordination and management of the medical oxygen systems at national, district and health facility levels.
4. To strengthen routine medical oxygen data collection and management information systems for surveillance of hypoxaemia and medical oxygen access.
5. To mobilize resources for strengthening medical oxygen systems at national, district and health facility levels.

3.3 Prioritized interventions and activities in the medical oxygen scale up plan

Table 6: Interventions and activities

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
Objective 1: To strengthen Hypoxaemia diagnosis, management and improve oxygen utilization		
Create an enabling environment for management of Hypoxaemia	MOH - Directorate of Curative services	Identify the national policies and guidelines to be revised/updated to include hypoxaemia management and oxygen use.
		Revise/update the identified national policies and guidelines and disseminate to the health facilities and pre-hospital care team
Improve clinical use of oxygen and maintenance of equipment by health care team	MOH-CSD, MOH-DPNM	Develop and roll out SOPs/protocols/job aides on hypoxaemia management in both the hospital and pre-hospital space.
		Update and disseminate guidelines for oxygen quantification and documentation of oxygen consumption.
		Conduct capacity building for the clinical team and paramedics in hypoxaemia diagnosis and management
		Integrate hypoxaemia management into routine support supervision visits by districts, RRHs and Ministry of Health
	MOH - Directorate of Curative services, MOH-CSD, MOES	Review the curricula of all health training institutions to include hypoxaemia management and basic maintenance of oxygen equipment as a stand-alone course unit.
Improve patient safety	MOH-IPC, MOH-CSD	Develop infection prevention and control procedures in relation to hypoxaemia management (e.g. application of 4-way bucket system for reusable oxygen delivery devices, disinfection of oxygen equipment)
	MOH-CSD	Identify /Institute clinical KPIs and patient satisfaction KPIs related to oxygen therapy and leverage state-level NRH/RRH/MO-in-charge meetings to report on KPI progress
		Support hypoxaemia management and oxygen therapy quality improvement projects by multi-disciplinary quality improvement teams through support supervision visits

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
Objective 2: To strengthen medical oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels		
Expand Oxygen Production Capacity	MOH-HID	Installation and Commissioning of 18 new PSA plants at NRHs and RRHs
	MOH-HID, Facility In-charges	Procure 4 additional PSA plants for UCI, UHI, Murchison Bay and Kisoro GH (1x 50m3 and 3x100m3)
	RRHs, MOH-HID, MOFPED	Support for utility costs of Oxygen plants, concentrators and other oxygen installations
	MOH-HID	Pilot 30 cubic meter plants at GHs (i.e. Iganga and Kawolo hospitals)
	MOH-HID, GH superintendents	Needs assessment for demand for future plants in GHs and islands
	MOH-HID, NMS	Annual Technical and Financial review of the Oxygen plants and delivery/distribution systems performance
	MOH-HID, NMS	Expand the Supply mix of Oxygen to include Liquid oxygen systems. Cryogenic tank refills for 60,000 liters at NMS and 16,000 liters at Mulago
	MOH-HID, NMS	Feasibility study for the need of a cryogenic production plant
Improve power quality, supply and reliability to Health Facility	MOH-HID	Assessment for transformer capacity need for upgrade
	Facility in-charges, MOH-HID, UMEME	Upgrade current power transformer capacity to at least 1,000KVA for facilities with plants
	MOH-HID	Procure central power stabilization systems for all Health Facilities with PSA plants
	Facility in-charges, MOH-HID, ERA, UMEME	MOH to engage stakeholders: Ministry of Energy, ERA and UMEME on the quality of power supplied to Health Facilities
	Facility in-charges, MOH-HID, MEMD, UMEME, Civil society leaders	Connect NRHs, RRHs, GHs to uninterrupted power supply (dedicated power lines)
	Facility in-charges	Costing oxygen production power bills
	MOH-HID, DHOs, Facility in-charges	Needs assessment for demand for future plans for solar powered concentrators at hard-to-reach facilities

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
	MOH-HID, DHOs, Facility in-charges	Installation of solar power systems to run oxygen concentrators at hard-to-reach facilities
Promote/utilize research & innovation to identify alternative mechanisms for production and delivery of oxygen to support supply	MOH-HID, DHOs, Facility in-charges	Bi-annual review of new and upcoming technologies to support production and supply
	Teaching and research institutions	Develop and implement an innovation hub for oxygen
Strengthen public-private partnership/collaboration in oxygen production/supply	MOH, NDA, Private sector, UHF	Develop a collaborative framework with the private suppliers
	NDA, UNBS	Accredit private production sites to ensure quality of oxygen supplied
	MOH, UHF, Faith-based medical bureaus, JMS	Installation of Plants at high-volume Private facilities on placement model
Optimize functionality of equipment (production and delivery)	MOH-HID, Facility in-charges	Procure & maintain 3-year planned preventive maintenance kits for all PSA plants
	MOH-HID, Facility in-charges	Sign framework for oxygen therapy equipment preventive and corrective maintenance contracts with service providers (2-year period)
	MOH-HID, Central workshop, Regional Workshops	Quantify and conduct Pooled procurement of spare parts for concentrators and oxygen therapy equipment and distribution according to need (quantify for storage space)
	MOH-HID, Central/Regional Workshops	Monitoring of maintenance plans for equipment (bi-annually) (quantified and costed PPM schedules)
	MOH-HID, Facility in-charges	Continuous Needs assessment/gap analysis for equipment at different levels of care
	MOH-HID, Central/Regional Workshops	Conduct factory training (TOTs) and certification for biomedical engineers on maintenance and repair of oxygen plants
Conduct quality assurance and implement quality control measures for oxygen diagnostics and equipment	MOH-HID, NACME, NDA, UNBS, MOH-DPNM, MOH-CSD, medical device companies, Academia	Standardize and Harmonization specifications for procurement of equipment (model, brands, and recommended equipment per level of care)
	MOH-HID, MOH-DPNM, UNBS	Review guidance for registration/importation of equipment

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
	NACME, MOH-HID,	Review, update and disseminate NACME guidelines in relation to oxygen equipment procurement, donation, and disposal
	MOH-HID, NMS	Set up a testing facility for medical gas equipment for fitness for use and safety
	MOH-HID, Facility In-charges, regional workshops	Develop SOPs for quality checks for basic testing for functionality of cylinders
	MOH-HID	Procure Analyzers and pressure meters for concentrators
Create awareness on good manufacturing practices and guidelines for minimum standards for local production	NDA, UNBS, MOH, Public, Health Education and Promotion Division (HEPD), DPNM, MOH-HID	Review of the current UNBS standard on Oxygen for Medical Use DUS 1511:2014
		Monitor and ensure compliance for quality standards for in-country production (off-site/factory and onsite)
	NDA, UNBS, local production facilities, MOH-DPNM, MOH- HID	Conduct Q.A tests on medical oxygen
Ensure availability of oxygen diagnostics and equipment	MOH-DPNM, MOH-CSD, MOH-HID	Integrated quantification of oxygen and related supplies into the national quantification process
	MOH-DPNM, MOH-CSD, MOH-HID	Develop list of MOH preferred products (for pooled procurements, maintenance, and repairs)
	MOH-HID, Health Facilities	Procurement of Oxygen concentrators and cylinders for all the facilities in need
	MOH-DPNM, MOH-CSD, MOH-HID	Update EMHSL to include oxygen and oxygen supplies (humidifier bottles and regulators) and indicate the level at which medical oxygen should be available.
	NACME, MOH-HID, MOH-DPNM, MOH-CSD	Review the National Medical Equipment Policy/guidelines to include oxygen therapy equipment and accessories
Improve oxygen supply chain coordination and accountability.	MOH-HID, NMS, MOH-DPNM	Develop and disseminate guidelines on Oxygen Management covering production, distribution, roles and responsibilities, quantification, revenue management and related aspects.
	MOH-HID, NMS, MOH-DPNM	Capacity Building of biomedical engineers, oxygen production plant technicians,

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
		pharmacists, inventory management officers in Oxygen Management
Improve oxygen inventory management.	MOH-HID, Regional Workshops, NMS, MOH-DPNM, Warehouses, MOH-DHI, MOH-ICT, Service providers	Digital marking for cylinders for tracking and traceability (bar codes, QR codes, serial numbers, GS1)
	MOH-DPNM, MOH-DHI, MOH-ICT	Strengthen the use of intra-facility inventory management system for oxygen products
	MOH-HID, MOFPED, MOH-DHI	Integration of Medical Equipment Inventory Information system (NOMAD) with the Asset registry systems of RRHs
	MOH-HID, MOH-DPNM, MOH-CSD, NMS, Health facilities	Construction of storage facilities for cylinders at NRHs, RRHs, GHs, HCIVs
	MOH-DPNM, MOH-HID	Procurement of fork-lifts for the RRHs regional hub stores to ease handling of increased cylinder volumes
Expand manifold systems	MOH-HID	Technical evaluation and sizing for manifolds and piping per level of care - assessment was done down to GHs
	MOH-HID, CSOs, Regional workshops,	Rollout of piping for NICUs, theatres, emergency wards, ICU down to HCIV level
	MOH-HID, MOH-CSD, RRHs,	Assess facilities, and Install pressure boosters to facilitate direct piping for ICUs for RRHs
	MOH-HID	Procure oxygen meter gauges for manifold systems
	MOH-HID, Academia, CSOs,	Utilize innovations for low pressure-piping for HCIVs and HCIIIs (e.g. FreO2, Low Pressure Reservoir, O2 Cube, solar powered concentrators, and other innovations)
Increase access and availability of Oxygen to all levels of care down to HC III including Private facilities & Ambulances	PS, NMS, MOH-DPNM	Implement the oxygen distribution model for Uganda including ordering and delivery plan
	MOH-DPNM, NMS, JMS	Logistics need mapping by region
	MOH-HID, NMS, MOH- DPNM, RRHs	Procure specialized trucks for LMD of cylinders or outsource LMD to private transporter

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
Expand human resource capacity for Plant production, maintenance, inventory management and supply chain coordination	PS, MOH-PR, MOH-NOC	Support remuneration of National Oxygen Coordinators in the secretariat of the National Oxygen sub-committee (2 staff i.e. Oxygen logistician & Oxygen coordinator)
	Public Service, MOH-HID, MOH-HR,	Advocate for interim recruitment of plant operators based on the approved current plan
	Public Service, MOH-HID, MOH-HR,	Review and update human resource structure at National & RRHs to include Plant Production Technicians, Biomedical Engineers & Porters
	Public Service, MOH-HID, MOH-HR,	Develop job descriptions for Plant Production Technicians
	Public Service, MOH-HID, MOH-HR,	Advocate for the recruitment of Plant Production Technicians (4 per site), additional Biomedical Engineers (2 per HF with oxygen plant) and Porters (6 per site) (Including the 2 GHs piloted)
	MOH-DPNM, MOH-HR, Public Service	Advocate for the recruitment of 2 assistant inventory management officers per RRH
	NMS, MOH-DPNM, MOH-HID	Advocate for the recruitment of truck drivers, turn-men and forklift drivers (24 drivers, 24 turn-men, 24 forklift drivers)
Objective 3: To strengthen coordination and management of the medical oxygen systems at national, district and health facility levels.		
Transition the national oxygen task force into a national coordination unit (sub-committee) for medical oxygen.	MOH, Director Curative services	Establish National Oxygen sub-committee and ensure that there is representation from Clinical, Nursing, EMS, HID, Pharmacy, Regional Referral Hospital Directors, the Chair for the DHO plus regional representation, National Advisory Committee on Medical Equipment, NMS, SCAPP and partners. Stipulate terms of reference for the committee i.e structure, frequency of meetings etc.
		Operationalize the National Oxygen sub-committee and secretariat.
Joint oxygen planning, coordination and performance review for effective	MOH-NOC	National Oxygen sub-committee to develop a work plan and provide oversight for its implementation.
		Bi-annual stakeholders meeting to review performance and needs

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
utilization of available resources for oxygen scale-up		Annual medical oxygen conference to take stock of strategic plan implementation
		Designation of district and facility-based oxygen focal person to be integrated into the existing medicines and therapeutic committee and other relevant committees – RRHs, GHs, HCIVs, etc
Objective 4: To strengthen routine medical oxygen data collection and management information systems for surveillance of Hypoxaemia and medical oxygen access		
Improve visibility, traceability and data use for oxygen production, consumption and logistics (ordering, inventory)	MOH–CSD, MOH-DHI	Roll out the 105 (monthly report) addendum of the HMIS tool that has oxygen indicators
	MOH–CSD, MOH-DHI	Update HMIS primary data tools (registers) during next scheduled HMIS revision
	MOH-DPNM, MOH-CSD, MOH-DHI, MOH-ICT	Incorporate in-transit hypoxaemia management (ambulance) and oxygen stock management data into HMIS and DHIS2
	MOH-DPNM, MOH-CSD, MOH-DHI, MOH-ICT	Addition of Oxygen as a tracer medicine or own dedicated section in HMIS manual
	MOH-DPNM	Develop guidelines on quantification (possibly as part of guidelines on oxygen supply management)
	MOH-DPNM, NMS	Include oxygen in the annual procurement planning process carried out by NMS/Pharmacy department
	MOH-DPNM, MOH-DHI, MOH-HID, Regional workshops	Review and update LMIS tools to include oxygen
	NMS, JMS, MOH-DHI, MOH-DPNM,	Incorporate oxygen and consumables as a commodity in the warehouse ordering platforms
	MOH-HID	Creation and rollout of the Oxygen Plants' Remote Monitoring System (OPRMs) to monitor the functionality of oxygen plants and the production of medical oxygen
Digitalize oxygen equipment and	MOH-HID, MOH-ICT	Roll out the electronic medical equipment inventory information system beyond regional workshops to districts and health facilities

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
oxygen supply systems.	NMS	Integrate oxygen in NMS electronic ordering system to enable health facilities to submit their oxygen orders electronically
Improve data dissemination for use in decision-making	MOH-DHI, MOH-ICT, MOH-NOC	Develop and maintain a hypoxaemia management dashboard in DHIS2 to monitor the performance of health facilities and districts in hypoxaemia management and the implementation of the national medical oxygen scale up plan
	MOH-DHI, National Oxygen Committee	Analyze data to inform decision-making at facility, regional, and national levels (dash boards in DHIS2 and Medical Equipment Inventory System)
Build capacity of relevant health care teams on the reporting and utilization of high-quality use of data for oxygen	MOH-DHI, Implementing partners	Print and distribute hypoxaemia management reporting tools (HMIS 105b addendum) and case notes to health facilities
	MOH-DHI	Train data collectors (medical records officers) on how to collect data for performance indicators
	MOH-DPNM, MOH-DHI, MOH-HID, Regional workshops	Capacity building/training of logisticians and clinicians on reporting and data management
	MOH – CSD, MOH-HID, MOH-DPNM, RRHs, Districts	Incorporate oxygen data management into routine support supervision visits by MOH, RRHs and districts.
	MOH-DPNM, MOH-HID	Design and implement quality improvement mechanisms for oxygen logistics and equipment management
Create and maintain an open-access research repository for Hypoxaemia management	MOH-NOC	Conduct learning review every 12 months (collect data and review trends) (Annual performance review workshops)
	MOH-CSD, MOH-HID	Support piloting of oxygen technologies and dissemination of results
Objective 5: To mobilize resources for strengthening medical oxygen systems at national, district and health facility levels		
Prioritize oxygen for funding under general health budget.	MOH-NOC	Quantify and budget for all oxygen needs (equipment, maintenance, training, supervision etc) to inform increased budget allocation.

Strategy/Intervention (How)	Responsible entity (Who)	Activities (What)
	MOH, MOH-DPNM, NMS	MOH/NMS to request the MOFPED to allocate a separate budget line for oxygen commodities.
	MOH- NOC	Submission of recommended technical and support staff for oxygen management for inclusion in MOH/Public Service staffing review
		Development of MOU and allocation of funds to JMS to supply oxygen to PNFPs
Explore financing options to cover cost of oxygen production by government plants.	MOH-PS	Ministry of Health to engage H.E, Ministry of Energy, and Ministry of Finance on health facilities receiving exemption/subsidy for power costs
	MOH-HID, MOH-DPNM	Quantification of unit cost for oxygen cylinder refills.
	MOH, MOFPED	Approval of proposed unit cost by MOH/MOFPD and utilization of funds received to support operation and maintenance of the plants.
	MOH-HID	Develop and implement oxygen plant income generation mechanism
Joint oxygen planning, coordination and performance review for effective utilization of available resources for oxygen scale-up	MOH-NOC	National Oxygen sub-committee to develop the oxygen work plan and provide oversight for implementation and ensure activities are included in department workplans.
Mobilize resources from partners/donors to support identified funding gaps	MOH-NOC	Develop and share the national budget for oxygen related costs to inform partner funding mapping on quarterly basis.
	MOH-NOC	Develop proposal to funding agencies for oxygen needs based on information in updated oxygen scale-up plan.

4.0 Implementation arrangements

4.1 Overview

In line with global trends to ensure medical oxygen related interventions are addressed from a health systems perspective, this plan will be implemented through a multi-sectoral and inter-sectoral collaboration with substantial input of the public, Private-not-for Profit (PNFP) and private-for-profit health sectors.

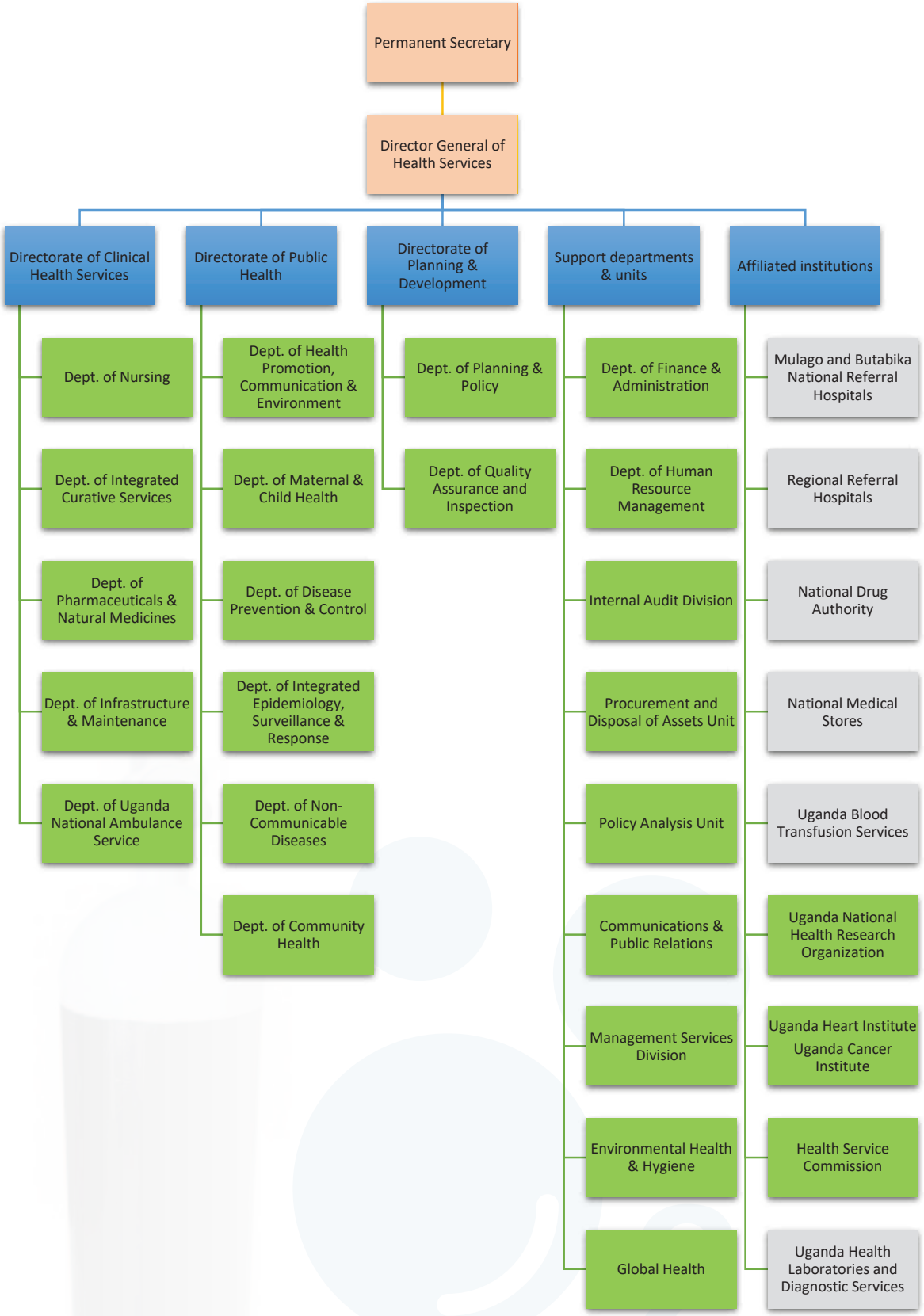
In line with the guidelines for MOH governance and management structures, this plan will be implemented through the existing health systems structures at the national, district and health facility levels as follows.

- At the national level, MOH through the Directorate of Curative Services will provide leadership and have overall responsibility for the implementation of the NPSSP. A subcommittee on medical oxygen systems at the MOH has been prioritized for establishment. It will be chaired by the Director of Health Services, Curative Services and it will consist of membership from the Departments of Clinical Services, Pharmaceuticals and Natural Medicines, Health Infrastructure and Emergency Medical Services at the minimum.
- Collaboration will involve partnerships with other MOH bodies such as NDA, NMS, and the National Medical Equipment Centre.
- In the private sector, implementation will be through Non-Governmental Organizations (NGOs), Private-not-for-Profit (PNFP) structures such as Joint Medical Stores, Medical Bureaus; Health Professional bodies and councils, academic institutions; Civil Society Organization (CSO); private oxygen production firms, among others.
- The plan will be co-financed by GOU through the Ministry of Health and various donors.

4.2 MOH organogram and linkage to Directorate of Curative Services

The Director General of Health Services (DGHS) oversees the technical aspects of health services at the ministry of health. The DGHS coordinates his work through the directorates i.e., Directorate of Curative Services, Planning and Development, Public Health; and affiliated institutions such as NDA, Butabika National Referral Hospital, Uganda Cancer Institute, etc. The support structure is composed of several departments such as finance and administration, internal audit and other technical departments.

Figure 5:Ministry of Health Organogram



4.3 Coordination and implementation mechanisms

The Director of Health Services, Curative Services through a **sub-committee on medical oxygen systems** consisting of consist of membership from the Departments of Clinical Services, Pharmaceuticals and Natural Medicines, Health Infrastructure and Emergency Medical Services at the minimum will spearhead provision of guidance, coordination, monitoring and evaluation of interventions of all actors involved in implementation of the plan. The sub-committee on medical oxygen systems will collaborate with the different stakeholders to ensure that the objectives of the plan are achieved in a harmonized manner.

This implementation plan for medical oxygen scale up will be the basis for development of annual work plans for interventions and activities relevant to strengthening medical oxygen systems. The implementation of activities will be in line with established mandate and responsibility holders as outlined in the implementation matrix. The plan will also inform the annual work plans of implementing partners and other bodies such as NDA, NMS, JMS, MBs, NGOs, academic institutions, health professional bodies and councils etc.

Performance review meetings will be organized by the **sub-committee on medical oxygen systems** to discuss issues and forge a way forward for any bottle necks encountered during the implementation period.
Progress will be reported in the relevant performance reports such as the Annual Pharmaceutical Sector Performance Report (APSPR). The **sub-committee on medical oxygen systems** will establish a suitable platform to collate and highlight progress across the different MDAs on medical related interventions.

The implementation plan for medical oxygen scale up will also be used as an instrument for mobilization of funds for the medical oxygen systems in the next five years. Activities will be prioritized based on availability of funds. Annual work planning and timelines will be aligned to the Constitution and the Public Financial Management Act 2015.

Coordination will be conducted at all levels of the health sector, as well as in the private sector.

4.3.1 National level coordination

The **sub-committee on medical oxygen systems with authority from the Director of Health Services, Curative Services** at the Ministry of Health will coordinate the implementation at the national level. It consists of equal membership and responsibility from the Departments of Clinical Services, Pharmaceuticals and Natural Medicines, Health Infrastructure and Emergency Medical Services. The sub-committee will engage state and non-state actors who are active in the medical oxygen ecosystem to ensure that their activities are aligned with the mandate of this plan.

Ministry of Health bodies such as NDA, NMS, Health Professionals Councils, and UNHRO will have overall responsibility and coordinate activities within their areas of jurisdiction and mandate. However, they will collaborate with the Directorate of Curative Services to ensure that the implementation of the plan is in sync with the objectives there of

Figure 6: Medical Oxygen Coordination mechanism

4.3.2 District level coordination

Coordination of the plan at the district level will be spearheaded by the Chief Administrative Officer (CAO) and District Health Officer (DHO) with technical guidance of the district health officer. The DHO will supervise and monitor all activities of implementing partners in the district.

4.3.3 Private sector coordination

The private healthcare care facilities will be coordinated through the Uganda Healthcare Federation (UHF).

4.4 Implementation Overview

Table 7: Implementation matrix

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Objective 1: To strengthen Hypoxaemia diagnosis, management and improve oxygen utilization							
Create an enabling environment for management of hypoxaemia	Updated national policies and guidelines on hypoxaemia management and oxygen use	MOH - Directorate of Curative services, MOH-CSD	Identify the national policies and guidelines to be revised/updated to include hypoxaemia management and oxygen use.					
			Revise/update the identified national policies and guidelines and disseminate to the health facilities and pre-hospital care team					
Improve clinical use of oxygen and maintenance of equipment by health care team	Standard operating procedures are developed and available in health facilities and ambulances	MOH-CSD, MOH-DPNM	Develop and roll out SOPs/protocols/job aides on hypoxaemia management in both the hospital and pre-hospital space.					
			Update and disseminate guidelines for oxygen quantification and documentation of oxygen consumption.					
	Clinical teams and paramedics trained.		Conduct capacity building for the clinical team and paramedics in hypoxaemia diagnosis and management					
	hypoxaemia management integrated routine support supervision		Integrate hypoxaemia management into routine support supervision visits by districts, RRHs and Ministry of Health					
	Hypoxaemia management and	MOH - Directorate of	Review the curricula of all health training institutions to include hypoxaemia					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	basic maintenance of oxygen equipment is integrated in existing curriculums	Curative services MOH-CSD, MOES	management and basic maintenance of oxygen equipment as a stand-alone course unit.					
Improve patient safety	Infection and prevention procedures are put in place	MOH-CSD-IPC Desk	Develop infection prevention and control procedures in relation to hypoxaemia management (e.g. application of 4-way bucket system for reusable oxygen delivery devices, disinfection of oxygen equipment)					
	Oxygen therapy integrated into the facility QI	MOH-CSD	Identify /Institute clinical KPIs and patient satisfaction KPIs related to oxygen therapy and leverage state-level NRH/RRH/MO-in-charge meetings to report on KPI progress					
			Support hypoxaemia management and oxygen therapy quality improvement projects by multi-disciplinary quality improvement teams through support supervision visits					
	Objective 2: To strengthen medical oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels							
Expand Oxygen Production Capacity	Plants installed and commissioned	MOH-HID	Installation and Commissioning of 18 new PSA plants at NRHs and RRHs					
	Plants procured	MOH-HID, Facility In-charges	Procure 4 additional PSA plants for UCI, UHI, Murchison Bay and Kisoro GH (1x 50m3 and 3x100m3)					
	Utility costs met to ensure operation of the equipment	RRHs, MOH-HID, MOF	Support for utility costs of Oxygen plants, concentrators and other oxygen installations					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Plants installed	MOH-HID	Pilot 30 cubic meter plants at GHs (i.e. Iganga and Kawolo hospitals)					
	A costed report for the need	MOH-HID, GH superintendents	Needs assessment for demand for future plants in GHs and islands					
	Performance review report	MOH-HID, NMS	Annual Technical and Financial review of the Oxygen plants and delivery/distribution systems performance					
	Filled tanks	MOH-HID, NMS	Cryogenic tank refills for 60,000 liters at NMS and 16,000 liters at Mulago					
	Study Report	MOH-HID, NMS	Feasibility study for the need of a cryogenic production plant					
Improve power quality, supply and reliability to Health Facility	Report with recommendations for sizing of the transformers and power stabilization equipment	MOH-HID	Assessment for transformer capacity need for upgrade					
	Installation and commissioning of the transformers and accessories	Facility in-charges, MOH-HID, UMEME	Upgrade current power transformer capacity to at least 1,000KVA for facilities with plants					
	Installation of power stabilization systems with ability for power factor correction	MOH-HID	Procure central power stabilization systems for all Health Facilities with PSA plants					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Consultative meetings	Facility in-charges, MOH-HID, ERA, UMEME	MOH to engage stakeholders: MEMD, ERA and UMEME on the quality of power supplied to Health Facilities					
	Connection of all hospitals to dedicated power lines	Facility in-charges, MOH-HID, MEMD, UMEME, Civil society leaders	Connect NRHs, RRHs, GHs to uninterrupted power supply (dedicated power lines)					
	Plants power bills	Facility in-charges	Costing oxygen production power bills					
	Assessment report	MOH-HID, DHOs, Facility in-charges	Needs assessment for demand for future plans for solar powered concentrators at hard-to-reach facilities					
	Solar systems installed	MOH-HID, DHOs, Facility in-charges	Installation of solar power systems to run oxygen concentrators at hard-to-reach facilities					
Promote/utilize research & innovation to identify alternative mechanisms for production and delivery of oxygen to support supply	Meeting report	MOH-HID, DHOs, Facility in-charges	Bi-annual review of new and upcoming technologies to support production and supply					
	Innovation hub launched	Teaching and research institutions	Develop and implement an innovation hub for oxygen					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Strengthen public-private partnership/collaboration in oxygen production/supply	Framework developed	MOH, NDA, Private sector, UHF	Develop a collaborative framework with the private suppliers					
	Accreditation of the private production sites	NDA, UNBS	Accredit private production sites to ensure quality of oxygen supplied					
	Plants installed on placement model	MOH, UHF, Faith-based medical bureaus, JMS	Installation of Plants at high-volume Private facilities on placement model					
Optimize functionality of equipment (production and delivery)	PPM kits procured based on the maintenance plan	MOH-HID, Facility in-charges	Procure & maintain 3-year planned preventive maintenance kits for all PSA plants					
	Framework Signed	MOH-HID, Facility in-charges	Sign framework for oxygen therapy equipment preventive and corrective maintenance contracts with service providers (2-year period)					
	Spare parts procured annually	MOH-HID, Central workshop, Regional Workshops	Quantify and conduct Pooled procurement of spare parts for concentrators and oxygen therapy equipment and distribution according to need (quantify for storage space)					
	Approved maintenance plans	MOH-HID, Central/Regional Workshops	Monitoring of maintenance plans for equipment (bi-annually) (quantified and costed PPM schedules)					
	Reports from NOMAD highlighting the gaps	MOH-HID, Facility in-charges	Continuous Needs assessment/gap analysis for equipment at different levels of care					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Biomedical Engineers trained	MOH-HID, Central/Regional Workshops	Conduct factory training (TOTs) and certification for biomedical engineers on maintenance and repair of oxygen plants					
Conduct quality assurance and implement quality control measures for oxygen diagnostics and equipment	Standard and Harmonized lists of Oxygen therapy and Pulse oximetry equipment.	MOH-HID, NACME, NDA, UNBS, DPNM, CSD, medical device companies, Academia	Standardize and Harmonization specifications for procurement of equipment (model, brands, and recommended equipment per level of care)					
	Guidelines for registration and importation of Oxygen equipment.	MOH-HID, UNBS, DPNM	Review guidance for registration/importation of equipment					
	Guidelines reviewed and disseminated.	NACME, MOH-HID,	Review, update and disseminate NACME guidelines in relation to oxygen equipment procurement, donation, and disposal					
	Testing facility established	MOH-HID, NMS	Set up a testing facility for medical gas equipment for fitness for use and safety					
	Reviewed Standard	MOH-HID, Facility In-charges, regional workshops	Develop SOPs for quality checks for basic testing for functionality of cylinders					
	Number of Analyzers and pressure meters procured	MOH-HID,	Procure Analyzers and pressure meters for concentrators					
Create awareness on good manufacturing	Reviewed Standard	NDA, UNBS, MOH, Public, Health	Review of the current UNBS standard on Oxygen for Medical Use DUS 1511:2014					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
practices and guidelines for minimum standards for local production	Certified and compliant local production facilities	Education and Promotion Division (HEPD), DPNM, HID	Monitor and ensure compliance for quality standards for in-country production (off-site/factory and onsite)					
	Proportion of Oxygen production facilities that meet the standard	NDA, UNBS, local production facilities, DPNM, MOH-HID	Conduct Q.A tests on medical oxygen					
Ensure availability of oxygen diagnostics and equipment	Oxygen and related consumables included on the Essential Medicines and Health Supplies list	MOH-DPNM, MOH-CSD, MOH-HID	Integrated quantification of oxygen and related supplies into the national quantification process					
	Developed and updated list	MOH-DPNM, MOH-CSD, MOH-HID	Develop list of MOH preferred products (for pooled procurements, maintenance, and repairs)					
	Oxygen cylinders and concentrators procured and delivered to facilities	MOH-HID, Health Facilities	Procurement of Oxygen concentrators and cylinders for all the facilities in need					
	Updated list	MOH-DPNM, MOH-CSD, MOH-HID	Update EMHSL to include oxygen and oxygen supplies (humidifier bottles and regulators) and indicate the level at which medical oxygen should be available.					
	Updated Guidelines	NACME, HID, MOH-DPNM	Review the National Medical Equipment Policy/guidelines to include oxygen therapy equipment and accessories					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Improve oxygen supply chain coordination and accountability.	Guidelines Developed and disseminated	MOH-HID, NMS, MOH-DPNM	Develop and Disseminate guidelines on Oxygen Management covering production, distribution, roles and responsibilities, quantification, revenue management and related aspects.					
	Improved quality of Oxygen Management	MOH-HID, NMS, MOH-DPNM	Capacity Building of biomedical engineers, oxygen production plant technicians, pharmacists, inventory management officers in Oxygen Management					
Improve oxygen inventory management.	Visibility, Track and Trace Model for Oxygen.	MOH-HID, Regional Workshops, NMS, MOH-DPNM, Warehouses, DHI, MOH-ICT, Service providers	Digital marking for cylinders for tracking and traceability (bar codes, QR codes, serial numbers, GS1)					
	Functional Integrated eLMIS inclusive of Oxygen Inventory and products	MOH-DPNM, MOH-DHI, MOH-ICT	Strengthen the use of intra-facility inventory management system for oxygen products					
	Integrated Asset Mgt system with Asset Mgt	MOH-HID, MOF, DHI	Integration of Medical Equipment Inventory Information system (NOMAD) with the Asset registry systems of RRHs					
	Storage facilities for cylinders	MOH-HID, MOH-DPNM, MOH-CSD, NMS, Health facilities	Construction of storage facilities for cylinders at NRHs, RRHs, GHs, HCIVs					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Functional forklifts procured	MOH-DPNM, MOH-HID	Procurement of fork-lifts for the RRHs regional hub stores to ease handling of increased cylinder volumes					
Expand manifold systems	Technical evaluation report with specifications and costing per level of care	MOH-HID	Technical evaluation and sizing for manifolds and piping per level of care - assessment was done down to GHs					
	Piped wards in the recommended wards up to HC IV	MOH-HID, CSOs, Regional workshops,	Rollout of piping for NICUs, theatres, emergency wards, ICU down to HCIV level					
	Assessment report	MOH-HID, RRHs, Clinical Services	Assess facilities, and Install pressure boosters to facilitate direct piping for ICUs for RRHs					
	Procured and installed oxygen meters	MOH-HID	Procure oxygen meter gauges for manifold systems					
	Piped facilities with low pressure oxygen systems and other innovations.	MOH-HID, Academia, CSOs,	Utilize innovations for low pressure-piping for HCIVs and HCIIIs (e.g. FreO2, Low Pressure Reservoir, O2 Cube, solar powered concentrators, and other innovations)					
Increase access and availability of Oxygen to all levels of care down to HC III including Private facilities & Ambulances	Approved distribution model and signed MOU between stakeholders	PS, NMS, MOH-DPNM	Implement the oxygen distribution model for Uganda including ordering and delivery plan					
	Report	MOH- DPNM, NMS, JMS	Logistics need mapping by region					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Number of trucks procured	MOH-HID, NMS, DPNM, RRHs	Procure specialized trucks for LMD of cylinders or outsource LMD to private transporter					
Expand human resource capacity for Plant production, maintenance, inventory management and supply chain coordination	Staff remunerated	PS, MOH-PR, Oxygen taskforce/sub committee	Support remuneration of National Oxygen Coordinators in the secretariat of the National Oxygen sub-committee (2 staff i.e. Oxygen logistician & Oxygen coordinator)					
	Interim plant operators recruited	Public Service, MOH-HID, MOH-HR,	Interim recruitment of plant operators based on the approved current plan					
	Reviewed structured including the plant production Technicians, Biomedical engineers and porters	Public Service, MOH-HID, MOH-HR,	Review and update human resource structure at National & RRHs to include Plant Production Technicians, Biomedical Engineers & Porters					
	Developed Job descriptions	Public Service, MOH-HID, MOH-HR,	Develop job descriptions for Plant Production Technicians					
	Staff recruited	Public Service, MOH-HID, MOH-HR,	Advocate for the recruitment of Plant Production Technicians (4 per site), additional Biomedical Engineers (2 per HF with oxygen plant) and Porters (6 per site) (Including the 2 GHs piloted)					
	Staff recruited	MOH-DPNM, MOH-HR, Public Service	Advocate for the recruitment of 2 assistant inventory management officers per RRH					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Staff recruited	NMS, MOH-DPNM, MOH-HID	Advocate for the recruitment of truck drivers, turn-men and forklift drivers (24 drivers, 24 turn-men, 24 forklift drivers)					
	Objective 3: To strengthen coordination and management of the medical oxygen systems at national, district and health facility levels.							
Transition the national oxygen task force into a national coordination unit (sub-committee) for medical oxygen.	National Oxygen sub-committee in place	MOH, Director Curative services	Establish National Oxygen sub-committee and ensure that there is representation from Clinical, Nursing, EMS, HID, Pharmacy, Regional Referral Hospital Directors, the Chair for the DHO plus regional representation, National Advisory Committee on Medical Equipment, NMS, SCAPP and partners. Stipulate terms of reference for the committee i.e structure, frequency of meetings etc.					
	Oxygen authority in place and functional		Operationalize the National Oxygen sub-committee and secretariat.					
Joint oxygen planning, coordination and performance review for effective utilization of available resources for oxygen scale-up	Workplan developed, 2 performance review meeting conducted annually	MOH, NOC	National Oxygen sub-committee to develop a work plan and provide oversight for its implementation.					
	Meeting report		Bi-annual stakeholders meeting to review performance and needs					
	Performance review report		Annual medical oxygen conference to take stock of strategic plan implementation					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	District and facility oxygen focal persons into MTCs.		Designation of district and facility-based oxygen focal person to be integrated into the existing medicines and therapeutic committee and other relevant committees – RRHs, DHs, HCIVs, etc					
	Objective 4: To strengthen routine medical oxygen data collection and management information systems for surveillance of Hypoxaemia and medical oxygen access.							
Improve visibility, traceability and data use for oxygen production, consumption and logistics (ordering, inventory)	105b Addendum rolled out	MOH–CSD, MOH-DHI	Roll out the 105 (monthly report) addendum of the HMIS tool that has oxygen indicators					
	Hypoxaemia indicators integrated in revised HMIS data tools	MOH–CSD, MOH-DHI	Update HMIS primary data tools (registers) during next scheduled HMIS revision					
	Oxygen stock management data incorporated in revised HMIS and DHIS2	MOH-DPNM, MOH-CSD, MOH-DHI, MOH-ICT	Incorporate in-transit hypoxaemia management (ambulance) and oxygen stock management data into HMIS and DHIS2					
	Medical Oxygen added to tracer medicines.	MOH-DPNM, MOH-CSD, MOH-DHI, MOH-ICT	Addition of Oxygen as a tracer medicine or own dedicated section in HMIS manual					
	Quantification guidelines developed.	MOH-DPNM	Develop guidelines on quantification (possibly as part of guidelines on oxygen supply management)					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Medical oxygen incorporated in NMS annual procurement process.	MOH-DPNM, NMS	Include oxygen in the annual procurement planning process carried out by NMS/Pharmacy department					
	Medical oxygen integrated in revised LMIS tools.	MOH-DPNM, MOH-DHI, MOH-HID, Regional workshops	Review and update LMIS tools to include oxygen					
	Medical oxygen and related consumables incorporated in warehouse ordering platforms.	NMS, JMS, MOH-DHI, MOH-DPNM,	Incorporate oxygen and consumables as a commodity in the warehouse ordering platforms					
	Remote monitoring system developed and rolled out.	MOH-HID	Creation and rollout of the Oxygen Plants' Remote Monitoring System (OPRMs) to monitor the functionality of oxygen plants and the production of medical oxygen					
Digitalize oxygen equipment and oxygen supply systems.	NOMAD rolled out to districts and health facilities.	MOH-HID, MOH-ICT	Roll out the electronic medical equipment inventory information system beyond regional workshops to districts and health facilities					
	Medical oxygen integrated in NMS electronic ordering system.	MOH-DPNM, NMS	Integrate oxygen in NMS electronic ordering system to enable health facilities to submit their oxygen orders electronically					
Improve data dissemination for use in decision-making	Hypoxaemia management dashboard developed.	MOH-DHI, MOH-ICT, NOC	Develop and maintain a hypoxaemia management dashboard in DHIS2 to monitor the performance of health facilities and districts in hypoxaemia management					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
			and the implementation of the national medical oxygen scale up plan					
	Data analysis reports.	MOH-DHI, NOC	Analyze data to inform decision-making at facility, regional, and national levels (dash boards in DHIS2 and Medical Equipment Inventory System)					
Build capacity of relevant health care teams on the reporting and utilization of high-quality use of data for oxygen	Hypoxaemia management reporting tools printed and distributed to health facilities.	MOH-DHI, Implementing partners	Print and distribute hypoxaemia management reporting tools (HMIS 105b addendum) and case notes to health facilities					
	Medical records officers trained to collect data for performance indicators	MOH-DHI	Train data collectors (medical records officers) on how to collect data for performance indicators					
	Clinicians and logisticians trained on reporting and data management.	MOH-DPNM, MOH-DHI, MOH-HID, Regional workshops	Capacity building/training of logisticians and clinicians on reporting and data management					
	Oxygen data management incorporated into routine support supervision.	MOH – CSD, HID, MOH-DPNM, RRHs, Districts	Incorporate oxygen data management into routine support supervision visits by MOH, RRHs and districts.					
	QI mechanisms for oxygen logistics and equipment management	MOH-DPNM, MOH-HID	Design and implement quality improvement mechanisms for oxygen logistics and equipment management					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	designed and implemented.							
Create and maintain an open-access research repository for hypoxaemia management	Meeting report	MOH-NOC	Conduct learning review every 12 months (collect data and review trends) (Annual performance review workshops)					
	Oxygen technologies piloted and results disseminated	MOH-CSD, MOH-HID	Support piloting of oxygen technologies and dissemination of results					
	Objective 5: To mobilize resources for strengthening medical oxygen systems at national, district and health facility levels							
Prioritize oxygen for funding under general health budget.	Oxygen related supplies reflected in heath unit budgets and required funding provided.	MOH-NOC	Quantify and budget for all oxygen needs (equipment, maintenance, training, supervision etc) to inform increased budget allocation.					
	Separate NMS budget line for oxygen related costs	MOH-DPNM, NMS	MOH/NMS to request the MFPED to allocate a separate budget line for oxygen commodities.					
	A staff structure that includes required technical/support staff for oxygen services	MOH- NOC	Submission of recommended technical and support staff for oxygen management for inclusion in MOH/Public Service staffing review					
	Signed MOU		Development of MOU and allocation of funds to JMS to supply oxygen to PNFPs					
Explore financing options to cover cost of oxygen	Reduced unit cost for power at RRHs.	MOH-PS	Ministry of Health to engage H.E, Ministry of Energy, and Ministry of Finance on health					

Strategy/Intervention (How)	Output	Responsible entity (Who)	Activities (What)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
production by government plants.			facilities receiving exemption/subsidy for power costs					
	Standardized cost of oxygen supply to PFPs	MOH-HID, DPNM	Quantification of unit cost for oxygen cylinder refills.					
	Proposed unit cost approved, and funds utilized to meet operational and maintenance costs.	MOH, MOFPD	Approval of proposed unit cost by MOH/MOFPED and utilization of funds received to support operation and maintenance of the plants.					
	Oxygen plant income generating mechanism developed.	MOH-HID	Develop and implement oxygen plant income generation mechanism					
Joint oxygen planning, coordination and performance review for effective utilization of available resources for oxygen scale-up	Workplan developed, 2 performance review meeting conducted annually	MOH-NOC	National Oxygen sub-committee to develop the oxygen work plan and provide oversight for implementation and ensure activities are included in department workplans.					
Mobilize resources from partners/donors to support identified funding gaps	Mapping of funding availed to the partners for oxygen budget	MOH-NOC	Develop and share the national budget for oxygen related costs to inform partner funding mapping on quarterly basis.					
	Funding request for oxygen scale-up approved	MOH-NOC	Develop proposal to funding agencies for oxygen needs based on information in updated oxygen scale-up plan.					

5.0 Quantification, Costing, and budget

5.1 Overview

It is challenging to estimate the five-year expenses for implementing the National Strategy throughout all 16 health zones due to the vast variation in oxygen needs each institution. To identify the best equipment, supply mix and other costs necessary to implement a comprehensive and functional oxygen delivery system, each region will need to examine characteristics across all facilities (HCIII, HCIV, GHs, RRHs and NRHs) and oxygen needs.

However, a projected budget based on evidence-based quantifications with some logical assumptions was developed. This budget specifically projects the costs needed to implement the National Strategy during a five-year period, from 2023 to 2028. The budget includes both supply costs (Capital expenditure and Operational expenditure) for the oxygen equipment required to maintain and properly use the equipment while also providing the expected amount of oxygen needed by hypoxemic patients throughout these healthcare institutions. The budget also includes costs associated with implementation of interventions mentioned under each objective above.

5.2 Medical Oxygen Quantification

First, a quantification of oxygen requirements by level of care over the next 5 years was conducted. The table below shows the national medical oxygen demand in cylinders ($6.8m^3$) over the next 5 years.

Table 8:National medical oxygen demand

Level of Care	YR1	YR2	YR3	YR4	YR5	TOTAL
	2023/24	2024/25	2025/26	2026/27	2027/28	
HC III	328,465	339,318	350,509	362,079	374,030	**1,754,401**
HC IV	225,874	233,329	241,039	248,988	257,211	**1,206,441**
General Hospital	290,537	311,344	342,922	320,273	420,033	**1,685,109**
RRH	141,609	146,314	157,062	165,010	173,116	**783,111**
NRH	68,086	70,331	72,676	75,100	77,590	**363,783**
Specialized Hospitals	43,511	44,163	45,654	47,183	48,775	**229,286**
Total annual demand	**1,098,082**	**1,144,799**	**1,209,862**	**1,218,633**	**1,350,755**	**6,022,131**

Key Quantification assumptions

- Oxygen therapy rolled out down to HCIII level by year 5.
- Annual Population growth rate 1.033.
- Adapted the UNICEF medical oxygen quantification tool.

5.2.1 Medical Oxygen Supply Gap Analysis

Table 9: Oxygen Supply Gap analysis

Year	YR1	YR2	YR3	YR4	YR5
	2023/24	2024/25	2025/26	2026/27	2027/28
Estimated Demand	1,098,082	1,144,799	1,209,862	1,218,633	1,350,755
Estimated Supply	254,604	1,400,334	1,400,334	1,563,393	1,563,393
Gap	843,478	(255,535)	(190,472)	(344,760)	(212,638)

The supply gap in year 1 shall be bridged by oxygen supply from the private sector. Expected supply of medical oxygen following installation of larger capacity PSA plants and Liquid oxygen systems to meet the estimated medical oxygen demand.

5.3 Costing

The National Medical Oxygen Scale-up plan was costed using the Activity Based Costing focusing on financial and incremental resources required to implement the Medical Oxygen Scale-up strategy. The National Medical Oxygen Scale-up plan is estimated to require **UGX 548.87B / USD 150.38M** over the period of 5 years. The funding requirement by objective over the 5-year period is as follows.

Table 10: Cost Analysis

OBJECTIVE	Year 1	Year 2	Year 3	Year 4	Year 5	Grand Total (Ugx)	Grand Total (Usd)
	2023/24	2024/25	2025/26	2026/27	2027/28		
Objective 1: To strengthen hypoxaemia diagnosis, management and improve oxygen utilization.	6,543,115,000	9,176,268,400	16,377,157,800	9,668,870,400	16,881,596,000	**58,647,007,600**	**16,067,673**
Objective 2: To strengthen medical oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels.	105,835,055,451	117,040,724,841	93,510,092,609	82,723,529,372	85,783,791,136	**484,893,193,409**	**132,847,450**
Objective 3: To strengthen coordination and management of the medical oxygen systems at national, district and health facility levels.	1,381,730,000	1,196,915,200	351,918,000	349,664,000	362,152,000	**3,642,379,200**	**997,912**

OBJECTIVE	Year 1	Year 2	Year 3	Year 4	Year 5	Grand Total (Ugx)	Grand Total (Usd)
	2023/24	2024/25	2025/26	2026/27	2027/28		
Objective 4: To strengthen routine medical oxygen data collection and management information systems for surveillance of hypoxaemia and medical oxygen access.	457,950,000	159,515,200	348,829,200	171,785,600	374,668,400	**1,512,748,400**	**414,452**
Objective 5: To mobilize resources for strengthening medical oxygen systems at national, district and health facility levels.	87,300,000	31,928,000	16,632,000	17,248,000	17,864,000	**170,972,000**	**46,842**
TOTAL (UGX)	**114,305,150,451**	**127,605,351,641**	**110,604,629,609**	**92,931,097,372**	**103,420,071,536**	**548,866,300,609**	**150,374,329**
TOTAL (USD)	**31,316,480**	**34,960,370**	**30,302,638**	**25,460,575**	**28,334,266**		

5.3.1 Cost Driver Analysis

The major cost drivers are highlighted below:

- **Capacity building-** interventions to build capacity on clinical use of oxygen, maintenance of equipment, oxygen inventory management and the reporting and utilization of high-quality data.
- **Coordination and management** interventions on coordination including development of policy and guidelines.
- **Data visibility and digitalization-**
- **Equipment**-procurement of equipment (production, diagnostic and delivery).
- **Equipment maintenance**-Interventions designed to optimize functionality of equipment (production, diagnostic and delivery)
- **Human resources-**facilitate adequate staffing for supply systems(production).
- **Logistics (Distribution, storage and piping)**- interventions to ensure increased access and availability of oxygen to patients.
- **Oxygen Research and Innovation**
- **Oxygen utility cost-**power consumption (production equipment)
- **Quality improvement**

The interventions designed to optimize functionality of equipment (production and delivery) were allocated 43% of the resource estimates, while interventions to ensure increased access and availability of oxygen to all levels of care down to HC III including Private facilities & Ambulances were allocated 15.2 % of resource estimates. In addition, the interventions focused on procurement of equipment (production, diagnostic and delivery) were allocated 14.4 % of resource estimates, whereas the interventions to build capacity on clinical use of oxygen, maintenance of equipment, oxygen inventory management and the reporting and utilization of high-quality use of data for oxygen were allocated 9.5 % of the resource estimates. The figure below shows the cost driver analysis.

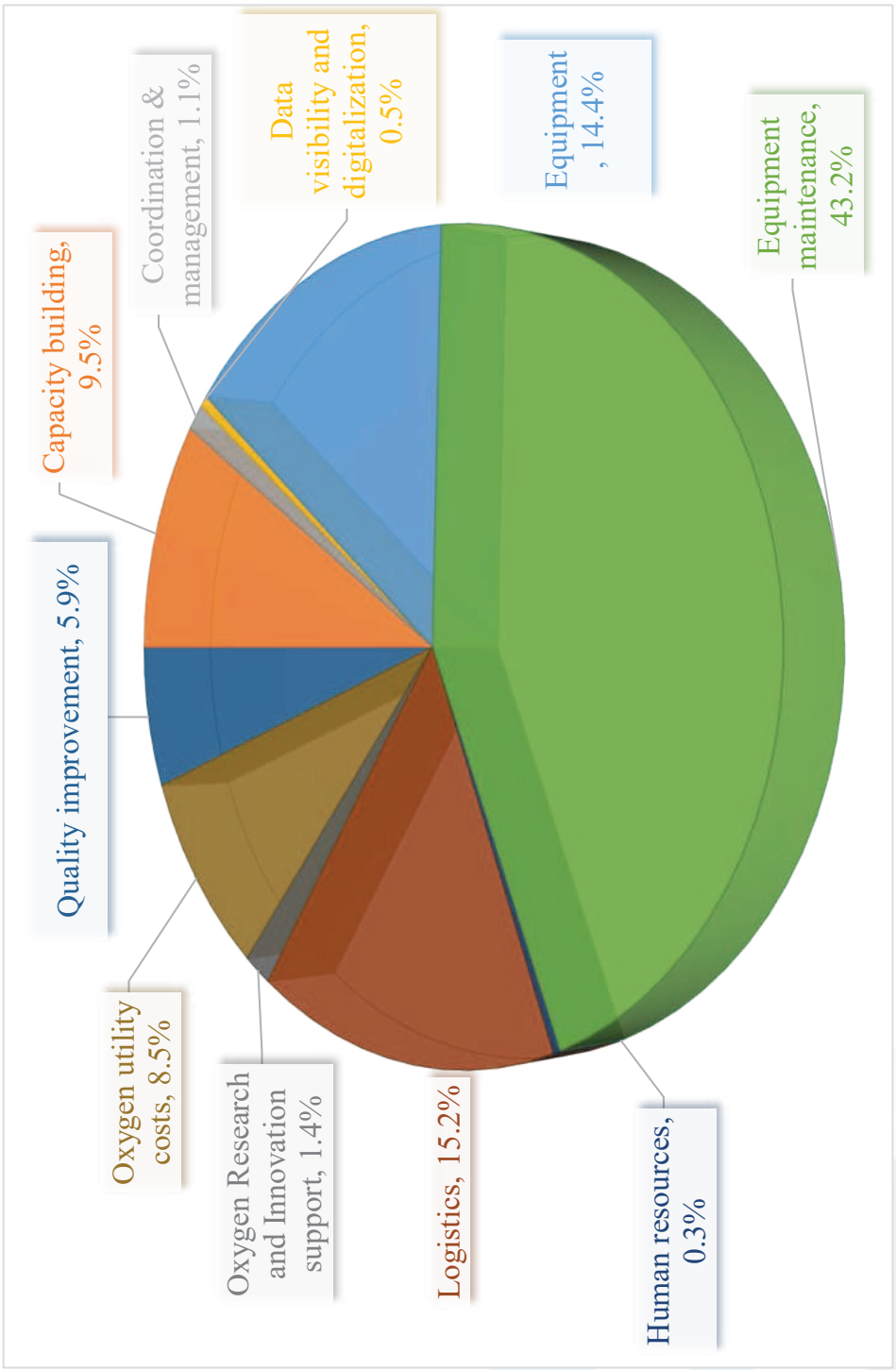


Figure 7: Cost driver analysis

5.3.2 Capital and Operational expenditure.

Table 11: Capital and Operational expenditure analysis

COST	Year 1	Year 2	Year 3	Year 4	Year 5	Grand Total (Ugx)	Grand Total (Usd)	%
	2023/24	2024/25	2025/26	2026/27	2027/28			
CAPEX	47,604,099,368	38,487,450,995	13,839,525,000	0	0	99,931,075,364	27,378,377	**18**
OPEX	66,701,051,083	89,117,900,646	96,765,104,609	92,931,097,372	103,420,071,536	448,935,225,246	122,995,952	**82**
TOTAL (UGX)	**114,305,150,451**	**127,605,351,641**	**110,604,629,609**	**92,931,097,372**	**103,420,071,536**	**548,866,300,609**	**150,374,329**	
TOTAL (USD)	**31,316,480**	**34,960,370**	**30,302,638**	**25,460,575**	**28,334,266**			

Capital expenditure accounts for 18% of the five-year Medical Oxygen Scale-up plan budget, while operational expenditure accounts for 82%.

Key Costing assumptions

1. Pulse Oximetry down to HCII level by year 5.
2. Oxygen therapy down to HCIII level by year 5.
3. Last mile distribution of medical oxygen down to HCIII level by year 5
4. A 4% inflation rate applied to the resource estimates beyond the second year.

5.4 Funding Strategy

The National Medical Oxygen Scale-up plan shall be funded by the GoU with the support from development partners. The GoU invested close to USD 23M to expand the country's oxygen systems, including procurement of 2 Cryogenic Oxygen storage tanks, 18 new PSA plants, 5,000 cylinders and repair and maintenance of existing plants. In addition, the GoU projects to fund the National Medical Oxygen Scale up plan to a tune of UGX 61.64B / USD 16.89M with additional support from the development partners estimated at UGX 93.68B / USD 25. 67M.The overall estimated funding gap is shown in the table below.

Table 12: Funding Gap Analysis

Year	YR1	YR2	YR3	YR4	YR5	TOTAL
	2023/24	2024/25	2025/26	2026/27	2027/28	
Resource Estimates of the plan (USD)	**31,316,480**	**34,960,370**	**30,302,638**	**25,460,575**	**28,334,266**	**150,374,329**
Resource Estimates of the plan (Ugx)	**114,305,150,451**	**127,605,351,641**	**110,604,629,609**	**92,931,097,372**	**103,420,071,536**	**548,866,300,609**
Projected Commitments						
Government of Uganda	3,680,867	3,339,241	3,188,061	3,282,037	3,396,586	**16,886,791**
Global Fund	12,233,696	0	0	0	0	**12,233,696**
CHAI	981,887	913,883	427,289	0	0	**2,323,059**
UCREPP	158,332	0	0	0	0	**158,332**
UNICEF	5,000,000	1,100,000	600,000	600,000	600,000	**7,900,000**
PATH	50,000	0	0	0	0	**50,000**
FREO2	0	1,000,000	1,000,000	1,000,000	0	**3,000,000**
Total Projected Commitments (USD)	**22,104,781**	**6,353,124**	**5,215,350**	**4,882,037**	**3,996,586**	**42,551,878**
Total Projected Commitments (Ugx)	**80,682,451,928**	**23,188,903,043**	**19,036,027,512**	**17,819,433,679**	**14,587,538,196**	**155,314,354,357**
Funding Gap (USD)	**9,211,698**	**28,607,246**	**25,087,288**	**20,578,538**	**24,337,680**	**107,822,451**
Funding Gap (Ugx)	**33,622,698,523**	**104,416,448,598**	**91,568,602,097**	**75,111,663,694**	**88,832,533,340**	**393,551,946,252**

As it stands, the National Medical Oxygen Scale-up plan has a funding gap of US $107.83 over the planned 5-year period.

5.4.1 Bridging the Gap

MOH through the National Oxygen sub-committee will devise resource mobilization strategies to close the funding gap. These strategies include:

- Optimize use of available resources through integration of some of the programmatic approaches with the view of improving on the efficiencies through reductions in duplications and minimizing resource wastes.
- Inclusion of medical oxygen interventions within departments annual work plans.
- Advocate for further allocation of resources within the health sector budgets for medical oxygen.
- Implement mechanisms to generate revenue from the sale of medical oxygen to the private sector to fund the maintenance and repair of the PSA plants.
- Lobby for further funding from the development partners.

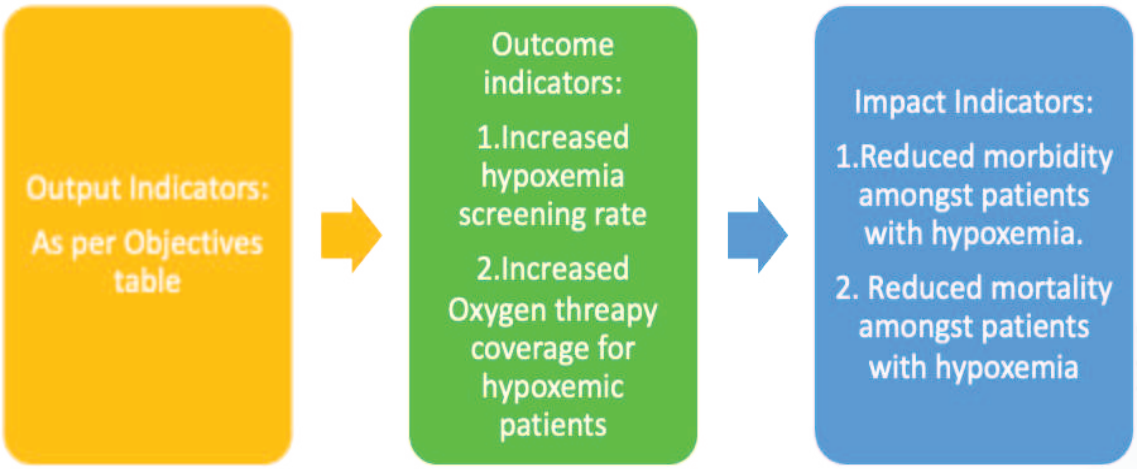
6.0 Monitoring and evaluation

6.1 Overview

The MOH will oversee an annual planning exercise at the national level to assess progress toward the scale-up strategy's goals and pinpoint initiatives to which funding should be properly allocated. More specifically, based on the key performance indicators stated in the performance indicator framework below, the planning exercise of the national coordinating mechanism will include a review of the impact of mobilized funds on the scale-up of medical oxygen. The examination of progress toward the scale-up targets will focus on data from medical facilities.

The scale-up plan's records, databases, and other existing structures will be used in conjunction with the performance monitoring framework below to track and assess progress using the key indicators listed below. Only the indicators listed under "Service Provision" will require tracking utilizing additional, dedicated resources that are not already available.

Figure 8: High level Indicators



6.2 Monitoring and Evaluation Framework

Table 13: Evaluation matrix

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
Objective 1: To strengthen hypoxaemia diagnosis, management and improve oxygen utilization	Percentage of patients in HC IVs and hospitals, screened for hypoxaemia using pulse oximetry at OPD (SpO2 documented)	Numerator: Number of new patients screened for hypoxaemia using pulse oximetry at OPD (SpO2 documented) Denominator: Number of new patients seen at OPD (New OPD attendance)	Age (<5 years, 5 years and above), Departments (OPD, IPD), Health care levels (HC IVs, GHs, RRHs)	None	70%	DHIS2 (HMIS 105B, HMIS 105)	Monthly
	Percentage of patients, HC IVs and hospitals, with hypoxaemia, given Oxygen for treatment (Given Oxygen)	Numerator: Number of patients, with hypoxaemia, given Oxygen for treatment (Given Oxygen) Denominator: Number of patients diagnosed with hypoxaemia (SPO2 < 90)	Age (<5 years, 5 years and above), Departments (OPD, IPD), Health care levels (HC IVs, GHs, RRHs)	3%	60%	DHIS2 (HMIS 105B, HMIS 105)	Monthly
Objective 2: To strengthen medical	Percentage of referral hospitals (NRHs and RRHs) with functional	Numerator: Number of referral hospitals (NRHs and RRHs) with		58%	100%	Oxygen dashboard	Monthly

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
oxygen supply systems including implementation plans for oxygen-related equipment at national, district and health facility levels	oxygen plants	functional oxygen plants. Functional= Running and producing oxygen for at least 20 working days in a month Denominator: Number of referral hospitals (NRHs and RRHs)					
	Percentage of health facilities (HCIVs, GHs, RRHs, NRHs) with at least one functioning Pulse oximeter in each of the following departments (OPD, NICU, Pediatric in patient, Operation theatre and Maternity wards)	Numerator: Number of health facilities (HCIVs, GHs, RRHs, NRHs) with at least one functioning Pulse oximeter in each of the following departments (OPD, NICU, Pediatric inpatient, Operation theatre, and Maternity wards) Denominator: Number of health facilities	Health Facility level (HCIVs, GHs, RRHs, NRHs)	27%	100%	NOMAD	Monthly
	Percentage of health facilities (HCIVs, GHs, RRHs, NRHs) with at least	Numerator: Number of health facilities (HCIVs, GHs, RRHs, NRHs) with at	Health Facility level (HCIVs, GHs, RRHs,	23%	100%	NOMAD	Monthly

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
	one functioning Oxygen concentrator in each of the following departments (OPD, NICU, Pediatric inpatient, Operation theatre, and Maternity wards)	least one functioning Oxygen concentrator in each of the following departments (OPD, NICU, Pediatric inpatient, Operation theatre, and Maternity wards) Denominator: Number of health facilities	NRHs)				
	Percentage of health facilities (HCIVs, GHs, RRHs, NRHs) with at least one functioning Oxygen Cylinder in each of the following departments (OPD, NICU, Pediatric inpatient, Operation theatre, and Maternity wards)	Numerator: Number of health facilities (HCIVs, GHs, RRHs, NRHs) with at least one functioning Oxygen Cylinder in each of the following departments (OPD, NICU, Pediatric inpatient, Operation theatre, and Maternity wards) Denominator: Number of health facilities	Health Facility level (HCIVs, GHs, RRHs, NRHs)	32%	100%	NOMAD	Monthly
	Percentage of health facilities with a continuous supply of	Numerator: Number of health facilities with a continuous supply of	Health Facility level (HCIVs, GHs, RRHs,	46%	100%	DHIS2 (HMIS 105B,	Monthly

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
	medical oxygen (No stock out reported)	medical oxygen (No stock out reported) Denominator: Number of health facilities	NRHs)			HMIS 105)	
Objective 3: To strengthen coordination and management of the medical oxygen systems at national, district and health facility levels.	Existence of a National Oxygen coordination unit				1		
	Number of Biannual medical oxygen stakeholder engagement meetings held				10		6 months
	Number of Annual Oxygen scale-up performance review meetings held				5	Performance review meeting report	Annually
Objective 4: To establish routine medical oxygen data collection and management information	Percentage of health facilities reporting on hypoxaemia management using the HMIS/DHIS2	Numerator: Number of health facilities reporting on hypoxaemia management using the HMIS/DHIS2 Denominator: Number	Health Facility level (HCIVs, GHs, RRHs, NRHs)	None	90%	DHIS2 (HMIS 105B, HMIS 105)	Monthly

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
systems for surveillance of hypoxaemia and medical oxygen access		of health facilities					
	Percentage of health facilities reporting on oxygen stock management using the HMIS/DHIS2	Numerator: Number of health facilities reporting on oxygen stock management using the HMIS/DHIS2 Denominator: Number of health facilities	Health Facility level (HCIVs, GHs, RRHs, NRHs)	None	90%	DHIS2 (HMIS 105B, HMIS 105)	Monthly
	Percentage of health facilities using the NOMAD or any other MOH recommended information system for medical equipment inventory management	Numerator: Number of health facilities using the NOMAD or any other MOH-recommended information system for medical equipment inventory management Denominator: Number of health facilities	Health Facility level (HCIVs, GHs, RRHs, NRHs)	10%	90%	NOMAD	Monthly
	Percentage of referral hospitals reporting oxygen plant functionality and Oxygen production using the	Numerator: Number of referral hospitals (RRHs and NRHs) reporting oxygen plant functionality and Oxygen production		None	100%	Oxygen dashboard	Monthly

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
	recommended MOH information system	using the recommended MOH information system Denominator: Number of referral hospitals (RRHs and NRHs)					
Objective 5: To mobilize resources for strengthening medical oxygen systems at national, district and health facility levels	Proportion of funds allocated by the MOH to facilitate implementation of the scale-up plan from GOU, development partners, private companies, and individuals	**Numerator:** annual govt allocation for medical oxygen **Denominator:** health sector budget	Allocations per departments that are implied in the scale-up plan		Govt contributes 70% of SP budget	MOH departments report Resource tracking reports	Annually
		Numerator: annual allocations for medical oxygen from development partners **Denominator:** Total funding from development partners for health sector	Allocations per development partner		Development partners contribute 25% of the SP budget.	Development partners reports. MOH resource mapping report	Annually

Objective	Indicator	Definition	Disaggregation	Baseline	Target	Source	Frequency
						Resource tracking reports	
		Numerator: annual allocations for medical oxygen from the private sector/individuals **Denominator:** Total external funding (private sector/individuals) to the health sector	Allocations by an entity (company/individual)		Private sectors contribute 5% of the SP budget.	Private sector entities report Individuals Resource tracking reports	Annually

7.0 ANNEXES

Annex A. Medical Oxygen Scale up plan development taskforce

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Special appreciation goes to **Professor Arthur Kwizera**: consultant for the development of the plan.

Annex B. Partner Mapping

Figure 9: Medical oxygen Partner Map

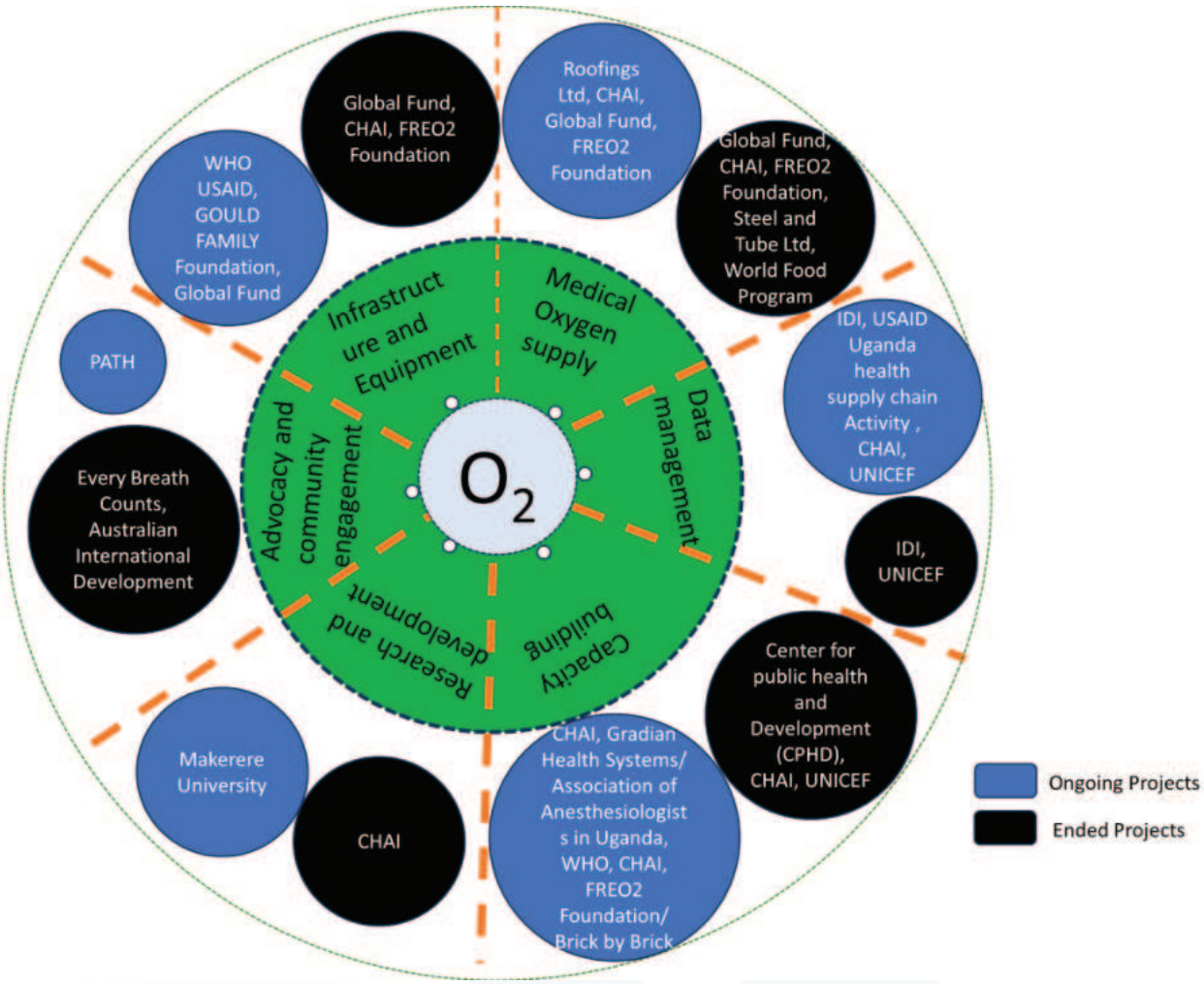


Table 14: Partner Investment in the Oxygen Space (COVID-19- 2023)

Funder	Medical Equipment, Consumables &Accessories	Production (PSA Plants, Backup power & LOX tanks)	Manifold Systems & Piping	Distribution (Cylinder refills & Trucks)	Total Investment ($)	Total Investment (Ugx)
AAU	21,350	-	-	-	**21,350**	**77,927,500**
ABSA	64,000	-	-	-	**64,000**	**233,600,000**
AFRICAN UNION	75,200	-	-	-	**75,200**	**274,480,000**
B'SMART	182,500	-	-	-	**182,500**	**666,125,000**
CHAI	2,188,275	141,365	248,147	-	**4,577,787**	**16,708,922,817**
CROWN	12,000	-	-	-	**12,000**	**43,800,000**
FREO2	42,450	-	-	-	**3,042,450**	**11,104,942,500**
GLOBAL FUND	3,369,040	6,100,975	148,136	300,000	**9,918,151**	**36,201,251,150**
LIFEBOX	70,000	-	-	-	**70,000**	**255,500,000**
GOU	5,560,390	27,120,000	-	-	**32,680,390**	**119,283,423,500**
MASINDI FOUNDATION	512,800	-	-	-	**512,800**	**1,871,720,000**
NILE BREWERIES	120,000	-	-	-	**120,000**	**438,000,000**
ROOFINGS GROUP	-	-	-	664,637	**664,637**	**2,425,924,320**

Funder	Medical Equipment, Consumables &Accessories	Production (PSA Plants, Backup power & LOX tanks)	Manifold Systems & Piping	Distribution (Cylinder refills & Trucks)	Total Investment ($)	Total Investment (Ugx)
STANBIC	39,200	-	-	-	**39,200**	**143,080,000**
UCREPP	123,197	-	-	35,135	**158,332**	**577,911,800**
UNICEF	6,005,509	2,178,403	-	-	**8,183,912**	**29,871,278,910**
USAID	556,450	-	111,102	-	**667,552**	**2,436,564,070**
WFP	35,000	-	-	-	**35,000**	**127,750,000**
WHO	2,154,750	-	-	-	**2,154,750**	**7,864,837,500**
GRAND TOTAL	**21,132,110**	**35,540,743**	**507,385**	**999,772**	**63,180,011**	**230,607,039,067**

Notes

- The GF piping support (USD 8,444,221.98) not included in the total investment
- Roofings supply to public facilities costed using a rate of UGX35000 per cylinder
- UCREPP investment include procurement of a transformer for Mulago Hospital Oxygen Plant and distribution of oxygen to RRHs

Table 15: Partner Landscape by Activity, Geographic scope and Project duration

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
Oxygen Equipment Supply	Global Fund	**Oxygen equipment procurement:** A total of USD $9M was provided for procurement of oxygen equipment to equip COVID-19 Treatment Units at national and regional referral hospitals and Emergency Medical Services (EMS) ambulances. This included PSA plants, cylinder transport trucks, mechanical ventilators, oxygen concentrators, oxygen cylinders, pulse oximeters and consumables. **Piping**: Support worth around UGX 32 billion towards piping of selected health facilities	Nationwide: COVID-19 Treatment Units (National Referrals Hospitals (NRH/RRHs) Nationwide: National Referrals Hospitals (NRH/RRHs) and General Hospitals (GHs).	Ending Ongoing
	CHAI	**Oxygen equipment procurement:** Equipment worth up to US$1.6M was made available to facilities across Uganda including the focal program facilities	Nationwide: COVID-19 Treatment Units (National Referrals Hospitals (NRH/RRHs) Eastern and Central regions	Ended
	FREO2 Foundation	**Equipment donation for COVID-19:** Donation of pulse oximeters and oxygen analyzers in support of the COVID-19 response. **Research and Innovation:** Low-cost oxygen systems	Nationwide: COVID-19 Treatment Units Mbarara University Teaching Hospital	2020-2022
	WHO	**Equipment donation for COVID-19:** COVID-19 Treatment Units received donations of oxygen cylinders and accessories. **Oxygen therapy Training**	Nationwide: COVID-19 Treatment Units	Ongoing

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
	USAID	**Technical support/Equipment donation for COVID-19:** Donated manifold systems, oxygen cylinders and nasal prongs.	Nationwide: COVID-19 Treatment Units	Ongoing
	UNICEF	**Technical support/Equipment donation for COVID-19:** Oxygen equipment was donated to COVID-19 Treatment Units and health facilities. This included four PSA plants, pulse oximeters, flow splitters, oxygen cylinders and nasal prongs.	Nationwide: COVID-19 Treatment Units	Ongoing
	Gould Family Foundation	**Technical support/Equipment donation for COVID-19:** Donated oxygen cylinders and concentrators and patient monitors to CTUs and is providing biomedical support to select CTUs	Nationwide: COVID-19 Treatment Units	Ongoing
Medical Oxygen Supply	CHAI	**Strengthened oxygen supply:** Piloted an oxygen distribution model centered around the PSA plants in Jinja and Mubende RRHs which informed the NMS exchange model. Providing oxygen last mile distribution support and supporting the installation of liquid oxygen systems.	Eastern and Central Nationwide	Ended Ongoing
	Roofings Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder refills for health facilities as part of the COVID-19 response.	Nationwide	Ongoing
	Steel & Tube Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder refills for health facilities as part of the COVID-19 response.	Nationwide	Ongoing
	Pramukh Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder refills for health facilities as part of the COVID-19 response.	Eastern Region	June-October 2021
	Tembo Steel Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder refills for health facilities as part of the COVID-19 response.	Eastern Region	June-October 2021
	Mayuge Steel Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder	Eastern Region	June-October 2021

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
		refills for health facilities as part of the COVID-19 response.		
	BM Steel Ltd	**Oxygen supply for COVID-19:** Providing pro bono oxygen cylinder refills for health facilities as part of the COVID-19 response.	Western Region	June-October 2021
	UNICEF	**Oxygen supply for COVID-19:** Funded oxygen cylinder refills for CTUs from private oxygen supplier	Nationwide	Ended
	World Food Programme (WFP)	**Oxygen cylinder transportation for COVID-19:** Availed trucks to support transportation of cylinders from CTUs to private suppliers for refilling	Nationwide	Ongoing
	UNHCR	**Oxygen cylinder transportation for COVID-19:** Availed trucks to support transportation of cylinders from CTUs to private suppliers for refilling	Nationwide	June-October 2021
	FREO2 Foundation	**Oxygen supply:** Piloting innovative low-cost oxygen systems at lower-level facilities, including a social enterprise approach to oxygen systems maintenance	Western and Central Uganda	Ongoing
	Global Health Labs (GH Labs)/ Gas Control Equipment (GCE)	**Oxygen supply:** Piloting innovative low pressure reservoir system as an alternative source of oxygen at lower-level facilities	Eastern Region	August – November 2021
Capacity Building for Oxygen Utilization, Repair and Maintenance	Center for Public Health and Development (CPHD)	**Training for technical staff:** Supported development of training curriculum for biomedical engineers and technicians on repair and maintenance of oxygen equipment, in collaboration with CHAI and MOH. With support from CHAI, CPHD trained MOH nominated trainers and supported the initial training sessions for regional workshop staff.	Nationwide: Central and regional workshops	Ended May 2021
	CHAI	**Healthcare worker training:** Improved health provider workforce capacity and diagnosis practices – Adopting a Training of Trainers (ToT) approach, 65 healthcare workers (HCWs) across 31	Eastern and Central	Ended

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
		health facilities (2 Regional Referral Hospitals (RRHs), 5 General Hospitals (GHs) and 24 HC IVs) who were awarded the responsibility of oxygen champions successfully cascaded the training and routinely mentored an additional 464 HCWs. Improving health provider workforce capacity and diagnosis practices.	Western Region	Ongoing
	Gradian Health Systems/ Association of Anesthesiologists in Uganda (AAU)	**Healthcare worker training:** As part of the ICU expansion project, Gradian in collaboration with AAU is delivering training on mechanical ventilation and critical care more broadly at the national and regional referral hospitals. This training was started in response to COVID-19 but likely to continue beyond COVID-19 to build capacity within the country. AAU has developed a 9-month critical care curriculum which has been endorsed by MOH and they are currently seeking support to roll-out the training.	Nationwide: COVID-19 Treatment Units	Ongoing
	FREO2 Foundation /Brick by Brick	**Oxygen Training:** Supporting health worker training on oxygen therapy at lower-level facilities.	Western and Central Uganda	Ongoing
	CHAI	**Training for technical staff:**37 Biomedical engineers/technicians (BME/Ts) and 17 PSA oxygen plant operators were trained across 17 RRHs on the repair and maintenance of oxygen equipment.	Nationwide	Ongoing
	WHO	**Technical support for COVID-19:** Oxygen therapy was included in the WHO COVID-19 training material.	Nationwide: COVID-19 Treatment Units	Ongoing
	UNICEF	**PSA plants repair and maintenance:** Funded repair and maintenance of oxygen plants.	Nationwide	Ended
	UNICEF	**Healthcare worker training:**	Nationwide	Ended

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
Oxygen Data Management	Infectious Disease Institute	**Equipment inventory system:** Developed and manages the equipment inventory system (NOMAD) for all facilities in Uganda. IDI will transition the system to MOH by Sept 2021.	Nationwide	Ongoing
	USAID, Uganda Health Supply Chain Activity	**Oxygen commodity tracking for COVID-19:** Developed and maintains the electronic Emergency Logistics Management Information System (eELMIS), a web-based tool which tracks and processes orders for emergency medical supplies (including oxygen consumables such as nasal prongs and non-rebreather masks). USAID also supported development of oxygen dashboard in collaboration with CHAI and MOH Division of Health Information.	Nationwide	Ongoing
	CHAI	**Data management and visualization systems:** Developed systems to monitor oxygen production and consumption as part of the COVID-19 response in 17 referral hospitals. This led to the establishment of an oxygen dashboard which continues to monitor oxygen production, distribution, consumption, and the availability and functionality of oxygen equipment in all referral hospitals. Additionally developed an HMIS addendum for monitoring oxygen indicators.	Nationwide	Ongoing
Research and developments	Makerere University Department of Anaesthesia and Critical care	**Clinical trial comparing different respiratory strategies for Hypoxaemia in adults, maternal and paediatric patients**	Nationwide	ongoing
	CHAI	**Conducted a HC III Hypoxaemia prevalence study:** The study was conducted across 30 HC IIIs and	Eastern and Central regions	Ended

Focus Area	Partner	Activity Details	Geographic Scope	Duration of Project
		found 6% of children under 5 years of age (N = 1,566 patients) seeking outpatient care at those facilities were either hypoxemic (SpO2<90%) or at risk for developing Hypoxaemia (SpO2 <94%). This translates to an estimated 225,000 children per year nationwide.		
Advocacy and Community Engagement	PATH	**Advocacy:** Supporting advocacy for oxygen scale-up in Uganda including raising awareness and advocating for resources.	Nationwide	Ongoing
	Every Breath Counts	**Advocacy:** Hosted several webinars to increase awareness of medical oxygen needs in Uganda and other African countries. This included a webinar for governments in Africa to discuss their medical oxygen policies and plans in the context of COVID-19 and the broader needs of their health systems and a webinar for partners to discuss access to medical oxygen in Africa during COVID-19.	Global	March, September 2021
	Australian International Development Network	**Advocacy:** Provided a platform in the form of a global webinar for Uganda to share experiences from COVID-19 pandemic and highlight the country's unmet needs, with the aim of mobilizing resources.	Global	June 2021

Annex C. Oxygen Supply Landscape

Table 16: Distribution of Oxygen PSA Plants

	Distribution of Oxygen plants across the country and their capacities in Nm3/hr						
		Existing capacity			Planned expansion		
S/N	Facility	SB	Genome	BHL	GGG	UNICEF	GF
1	Mulago NRH (Lower Mulago)	125					
2	Mulago NRH (new plant in Lower Mulago)	70					
3	Mulago NRH (Upper Mulago)		50		100		
4	Mulago National Isolation Center				100		
5	Mulago Women's Specialized Hospital		36				
6	Arua RRH	15			100		
7	Entebbe RRH	16			100		
8	Fort Portal RRH	15			100		
9	Gulu RRH	15			100		
10	Hoima RRH	15					100
11	Jinja RRH	15			100		
12	Kabale RRH	15			100	30	
13	Lira RRH	15					100
14	Masaka RRH	15			100	30	
15	Mbale RRH	15					100
16	Mbarara RRH (old plant)	10					100
17	Mbarara RRH new plant	11					
18	Moroto	15			100		

	Distribution of Oxygen plants across the country and their capacities in Nm3/hr						
		Existing capacity			Planned expansion		
S/N	Facility	SB	Genome	BHL	GGG	UNICEF	GF
19	Mubende RRH	15			100		
20	Naguru RRH	15			100		
21	Soroti RRH	15			100	30	
22	Kawempe NRH new plant	11			50		
23	Kawempe NRH old plant			10			
24	Kiruddu			10	50		
25	Butabika NRH				50		
26	Kapchorwa GH				50		
27	Kayunga RRH				100	30	
28	Yumbe RRH				100		
29	Iganga GH					30	
30	Kawolo GH					30	
31	Bombo MGH			2.5	100		

Table 17: Location of Cryogenic Tanks

CRYOGENIC TANKS					
#	Location	Level	Capacity (Litres)	Installation status (%)	Planned Utilization Mechanism
1	NMS (Kajjansi)	Regional Referral Hospital	60,000	75%	Supply to other health facilities
2	Mulago	National Referral Hospital	16,000	85%	Direct piping to the Hospital

Table 18: Larger Capacity PSA Plants Installation Status

Location/ Facility	PSA Plant Specifications (Manufacturer/Model)	Funding source	Maximum Output (in Nm3/hr)	Status
Entebbe RRH	Oxymat	GOU	100	Commissioning in September 2024.
Naguru RRH	Oxymat	GOU	100	Commissioning in September 2024.
Kayunga RRH	Oxymat	GOU	100	Commissioning in September 2024.
Jinja RRH	Oxymat	GOU	100	Commissioned and handed over.
Soroti RRH	Oxymat	GOU	100	Commissioning by December 2024
Moroto RRH	Oxymat	GOU	100	Commissioning by December 2024
Gulu RRH	Oxymat	GOU	100	Commissioning in August 2024.
Arua RRH	Oxymat	GOU	100	Commissioning by December 2024
Bombo Military General Hospital	Oxymat	GOU	100	Commissioning in August 2024.
Masaka RRH	Oxymat	GOU	100	Commissioning by December 2024
Mubende RRH	Oxymat	GOU	100	Commissioned and handed over.
Kabale RRH	Oxymat	GOU	100	Commissioning by December 2024
Fort Portal RR	Oxymat	GOU	100	Commissioning by December 2024
Yumbe RRH	Oxymat	GOU	100	Commissioning by December 2024
Mulago Isolation NRH	Oxymat	GOU	100	Commissioned and handed over.
Mulago Upper	Oxymat	GOU	100	Commissioned and handed over.
Butabika RH	Oxymat	GOU	50	Commissioning by December 2024
Kiruddu NRH	Oxymat	GOU	50	Commissioned and handed over.
Kawempe RRH	Oxymat	GOU	50	Commissioned and handed over.

Location/ Facility	PSA Plant Specifications (Manufacturer/Model)	Funding source	Maximum Output (in Nm3/hr)	Status
Mbale RRH	Met-tech	Global Fund	100	Commissioning in September 2024.
Lira RRH	Met-tech	Global Fund	100	Commissioning in September 2024.
Mbarara RRH	Met-tech	Global Fund	100	Commissioning in September 2024.
Hoima RRH	Met-tech	Global Fund	100	Commissioning in September 2024.

Annex D. Status of Piping of Key wards in Health Facilities

Table 19: CHAI-Funded Piped Health Facilities.

HOSPITALS PIPED WITH FUNDING FROM CHAI				
No	**Hospital Name**	**Level**	**Funder**	**Status**
1	Jinja	Regional Referral Hospital	CHAI	Pipped key medical wards
2	Mubende	Regional Referral Hospital	CHAI	Pipped key medical wards
3	Arua	Regional Referral Hospital	CHAI	Pipped key medical wards
4	Kabale	Regional Referral Hospital	CHAI	Pipped key medical wards
5	Mulago	National Referral Hospital	CHAI	Connection of new PSA plant to main medical gas pipeline
6	Kawempe	National Referral Hospital	CHAI	Connection of new PSA plant to main medical gas pipeline
7	Kiruddu	National Referral Hospital	CHAI	Connection of new PSA plant to main medical gas pipeline

Table 20: UNICEF-Funded Piped Health Facilities

HOSPITALS PIPED WITH FUNDING FROM THE UNICEF				
No.	**Hospital Name**	**Level**	**Funder**	**Status**
1	Masaka	Regional Referral Hospital	UNICEF	Pipped in key medical wards
2	Kayunga	Regional Referral Hospital	UNICEF	Pipped in key medical wards
3	Kabale	Regional Referral Hospital	UNICEF	Pipped in key medical wards
4	Soroti	Regional Referral Hospital	UNICEF	Pipped in key medical wards

Table 21: Health Facilities to be piped with funding from Global Fund

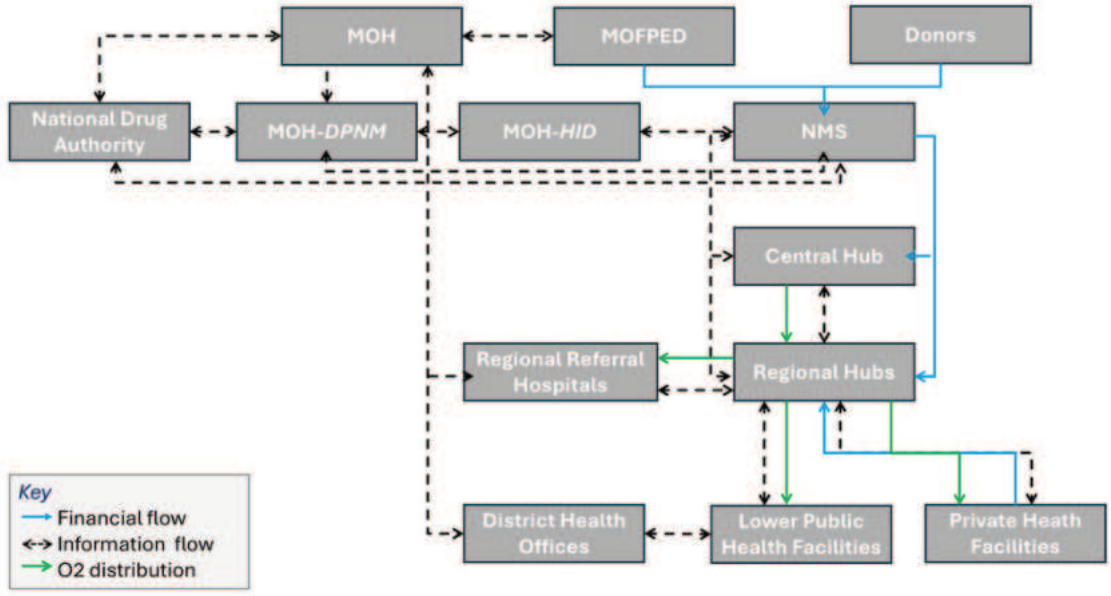
HOSPITALS TO BE PIPED IN FY 2024/2025 WITH FUNDING FROM THE GLOBAL FUND				
No.	**Hospital Name**	**Level**	**Funder**	**Status**
1	Naguru	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
2	Kawolo	General Hospital	Global Fund	To be pipped in FY 2024/2025
3	Mityana	General Hospital	Global Fund	To be pipped in FY 2024/2025
4	Nakaseke	General Hospital	Global Fund	To be pipped in FY 2024/2025
5	Gombe	General Hospital	Global Fund	To be pipped in FY 2024/2025
6	Jinja	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
7	Iganga	General Hospital	Global Fund	To be pipped in FY 2024/2025

HOSPITALS TO BE PIPED IN FY 2024/2025 WITH FUNDING FROM THE GLOBAL FUND				
No.	**Hospital Name**	**Level**	**Funder**	**Status**
8	Mbale	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
9	Moroto	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
10	Lira	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
11	Moyo	General Hospital	Global Fund	To be pipped in FY 2024/2025
12	Adjumani	General Hospital	Global Fund	To be pipped in FY 2024/2025
13	Anaka	General Hospital	Global Fund	To be pipped in FY 2024/2025
14	Gulu	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
15	Yumbe	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
16	Kabale	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
17	Fortportal	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
18	Itojo	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
19	Mbarara	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025
20	Hoima	Regional Referral Hospital	Global Fund	To be pipped in FY 2024/2025

Annex E. National Oxygen Distribution System

Regional Referral Hospital (RRH) oxygen plants will serve as regional hubs, distributing oxygen to both the RRH and health facilities within their catchment areas. These regional hubs will be supplemented by oxygen from central sources, such as the cryogenic tank at NMS and private suppliers, as needed. NMS will manage the transportation of oxygen cylinders to and from the regional hubs and health facilities using the exchange-on-delivery mechanism (Milkman model).

Figure 10: National Medical Oxygen Distribution Plan



Annex F. Hypoxaemia management and oxygen therapy guidelines.

Refer to the Uganda Clinical Guidelines 2023

Chapter 1.4

Annex G. Management of Medical Oxygen and related Supplies.

Refer to the Uganda Essential Medicines and Health Supplies Management Manual 2023

Chapter 9.

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