FEDERAL REPUBLIC OF NIGERIA

NATIONAL STRATEGY FOR THE SCALE-UP OF MEDICAL OXYGEN IN HEALTH FACILITIES

(2023-2027)

FEDERAL MINISTRY OF HEALTH

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Foreword

The second National Strategy on Medical Oxygen 2023-2027 builds on the foundations laid by the first plan (2017-2022) for more equitable access to medical oxygen in health facilities in Nigeria. Indeed, access to quality assured medical oxygen can mean the difference between life and death in patients with an indication for oxygen therapy. To ensure consistent availability of oxygen in facilities, and appropriate administration to patients with hypoxaemia, a strategic plan is required, to streamline efforts to ensure *all* patients receive oxygen therapy when and where needed.

Before the onset of the COVID-19 pandemic, Nigeria, like many other low-income countries suffered from inadequacy of medical oxygen across board, especially in rural areas but the COVID-19 pandemic starkly exposed these gaps in availability and access. The Federal Ministry of Health and health facilities in the country were faced with the daunting challenge of providing adequate oxygen supply to meet demand in Isolation and Treatment centres, over and beyond the usual requirement in normal health settings. At the facility level, it also became clear that insufficient number of oxygen production plants and a high number of non-functional plants, coupled with the inadequacy of electricity supply posed challenges for reliable oxygen supply availability. Shortage of trained staff, equipment such as cylinders and other devices to assess or monitor hypoxaemia levels or to deliver oxygen further constrained the health system in the country to provide oxygen for respiratory care support. Oxygen support remains essential in the treatment of acute and severe manifestations of respiratory diseases and other clinical conditions.

This second edition of the National Oxygen Strategy is aligned and set to measure the unprecedented investments and increase in general health infrastructure in Nigeria for Oxygen delivery and respiratory care management including the increasing number of oxygen production plants. It will provide the roadmap for engaging stakeholders across the entire oxygen system spectrum namely oxygen generation, distribution, administration, and equipment maintenance. It demonstrates the commitment of the Federal Government of Nigeria in making systematic and coordinated improvements in providing life-saving commodities, in this case, medical oxygen, to patients.

The successful implementation of the National Policy on Medical Oxygen and the revised strategy will require sustained engagement, feedback, and collaboration with stakeholders. I therefore urge all stakeholders to study the policy and strategy carefully to identify areas of relevance, how they can key in and synergistically contribute to achieving the drive for medical oxygen sufficiency across the whole Country.

Dr. Osagie Ehanire
Honorable Minister of Health

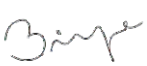
Acknowledgements

The Federal Ministry of Health (FMoH) expresses her profound gratitude and appreciation for the tremendous efforts and support received from all stakeholders especially Departments and Agencies, Donors as well as Partners that participated in the process of the review and validation of the National Strategy for the Scale-up of Medical Oxygen in Health Facilities in Nigeria (2023 – 2027).

Undoubtedly, there have been significant changes in the oxygen landscape due to the global pandemic. The multi-sectoral and multi-stakeholder consultative approach has therefore provided new perspectives and technical insights especially in considering pandemic preparedness towards ensuring that access to and availability of live-saving medical oxygen is uncompromised. With the primary goal of reducing morbidity and mortality due to hypoxaemia in Nigeria by addressing the key barriers limiting access to diagnostics and oxygen delivery systems in health facilities in the next five years and beyond, these stakeholders have focused their attention on developing a strategy that will achieve the stated goal.

We wish to specifically appreciate the valuable contributions efforts from the technical writing group and Partners who have supported this process, including:

- Clinton Health Access Initiative (CHAI)
- Oxygen for Life Initiative (OLI)
- United Nations International Children's Emergency Fund (UNICEF)
- World Health Organization (WHO)
- FHI 360
- Save the Children International (SCI)
- USAID
- Oxygen Hub
- Air Separation Nig. Ltd
- Industrial Medical Gases (IMG)
- Clinicians, Academicians, Biomedical Engineers, etc.



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Acronyms

ACT-A	Access to COVID-19 Tools Accelerator
AOP	Annual Operational Plan
BHCPF	Basic Health Care Provision Fund
BME/T	Biomedical Engineer/Technician
CHAI	Clinton Health Access Initiative
CME	Continuing Medical Education
COPD	Chronic Obstructive Pulmonary Disease
COREN	Council for the Regulation of Engineering in Nigeria
COVID-19	Coronavirus Disease 2019
DHIS	District Health Information System
DQA	Data Quality Assurance
DRF	Drug Revolving Fund
EBC	Every Breath Counts
EEL	Essential Equipment List
EML	Essential Medicines List
FCT	Federal Capital Territory
FGN	Federal Government of Nigeria
FMoH	Federal Ministry of Health
GFF	Global Financing Facility
HCW	Health Care Worker
HMB	Hospitals Management Board
HMIS	Health Management Information System
ICU	Intensive Care Unit
ISO	International Organization for Standardization
ISS	Integrated Supportive Supervision
LGA	Local Government Area
LMCU	Logistics Management Coordination Unit
LMIS	Logistics Management Information System
LOX	Liquid Oxygen
LPM	Litres Per Minute
LPOS	Low-Pressure Oxygen Storage

MDAs	Ministries, Departments and Agencies
MOH	Ministry of Health
NABET	The Association of Nigerian Biomedical Engineers and Technologists
NAFDAC	National Agency for Food and Drugs Administration and Control
NEMA	National Emergency Management Agency
NHIS	National Health Insurance Scheme
NHLMIS	National Health Logistics Management Information System
NHMIS	National Health Management Information System
NPHCDA	National Primary Health Care Development Agency
NSHDP	National Strategic Heath Development Plan
NSTG	National Standard Treatment Guidelines
PCV	Packed Cell Volume
PHC	Primary Health Care
PPP	Public Private Partnership
PSA	Pressure Swing Adsorption
QIT	Quality Improvement Team
RDF	Revolving Drugs Fund
RMNCH	Reproductive, Maternal, New-born and Child Health
RSSH	Resilient Structures for Strengthening Health
SARI	Severe Acute Respiratory Infection
SMoH	State Ministry of Health
SON	Standards Organization of Nigeria
SPHCDA	State Primary Health Care Development Agency
SPHCMB	State Primary Health Care Management Board
SpO2	Saturation of Peripheral Oxygen
THF	Tertiary Health Facility
TWG	Technical Working Group
U4O	United for Oxygen
WHO	World Health Organization

Executive Summary

Medical oxygen is a lifesaving essential medicine used to treat patients at all levels of the healthcare system from intensive care, newborn and child health care, anaesthetic, and surgical services to outpatient services. The clinical indication for oxygen therapy is hypoxaemia, which is referred to as low levels of oxygen in the blood. Hypoxaemia can be caused by various conditions like pneumonia, heart disease, bronchial asthma, anaemia, sepsis, malaria, obstetric complications amongst others. Globally, morbidity and mortality associated with acute and chronic lung disease in children and adults has been attributed to hypoxaemia. Hypoxaemia alone accounts for an estimated 120,000 deaths among children in Nigeria yearly.[1] Therefore, prompt diagnosis of hypoxaemia is critical to care and improved patient outcomes. The World Health Organization (WHO) recommends pulse oximetry as the standard for detecting and monitoring hypoxaemia in low- and middle-income countries (LMICs).

Findings from a recent national assessment showed that available medical oxygen infrastructure still struggles to meet demand. The global COVID-19 pandemic further highlighted this access gap and the need to urgently strengthen medical oxygen systems in the country. Access to safe and efficient oxygen is constrained by a lack of clear policies and guidelines, inadequate funding, limited availability of functional oxygen supply systems, weak equipment maintenance and repair systems, limited data to guide decision making, and inadequate skills and expertise among health workers and technicians.

Since the onset of the COVID-19 pandemic in 2020, federal and state governments (in collaboration with donors and development partners) have ramped up investments to increase access to safe and efficient medical oxygen in the country and through these investments, plan to build up the oxygen supply eco-system in the country not only to respond to current needs but to also respond to future pandemics.

Vision:

The vision of the National Strategy for the Scale-up of Medical Oxygen is to ensure that all patients with hypoxaemia in Nigeria are properly diagnosed and treated with medical oxygen. It is the vision of the FMOH that no patient in Nigeria dies from hypoxaemia.

Strategic directions and policy priorities:

The country's vision to ensure that all patients with hypoxaemia in Nigeria have access to medical oxygen and that there is no mortality due to hypoxaemia will be achieved by leveraging on past and

[1] UNICEF. A Promise Renewed Progress Report 2015. September 2015

more recent COVID-19 care investments in oxygen systems and by building on the achievements of the first ever National Oxygen strategy (2017 – 2022). It will align with the current National Strategic Health Development Plan (NSHDP - II) and other relevant government policies.

Goal:

The goal is to reduce morbidity and mortality due to hypoxaemia in Nigeria by addressing the key barriers limiting access to high-quality diagnostics and medical oxygen delivery systems in health facilities. Specifically, the National Strategy will increase equitable access to oxygen for the population over the next five years by achieving the following objectives:

- Improve governance, strengthen coordination and strategic partnerships for oxygen access scale-up in the country.
- Increase availability and quality of oxygen technologies and supplies at all levels through strengthened oxygen procurement and distribution systems.
- Improve clinical administration and technical management of oxygen at the facility-level.
- Increase sustainable, predictable, and consistent financing for oxygen access.
- Strengthen oxygen data, information and monitoring systems for appropriate oversight and management.

In summary, a set of focused high-impact interventions targeted at achieving these objectives will be implemented across all levels of the health system in Nigeria. Gaps in the availability of oxygen will be addressed systematically, including instituting appropriate supply models supported by adequate maintenance, training, financing, and monitoring. Successful implementation will rely on strong multi-sectoral collaboration and stakeholder engagement as well as availability of dedicated resources.

The availability of high-quality and functional oxygen supply systems will improve equitable access to oxygen and, in so doing, would significantly reduce mortality from hypoxaemia in Nigeria. In children under five (U5), improved oxygen access coupled with clinical training, supervision, and improvements in broader patient care practices at the facility level led to marked reductions in mortality due to pneumonia by 35%.[2] Scaling up this approach across all levels of the health care system and in all states will significantly reduce morbidity and mortality for a variety of health conditions in the country.

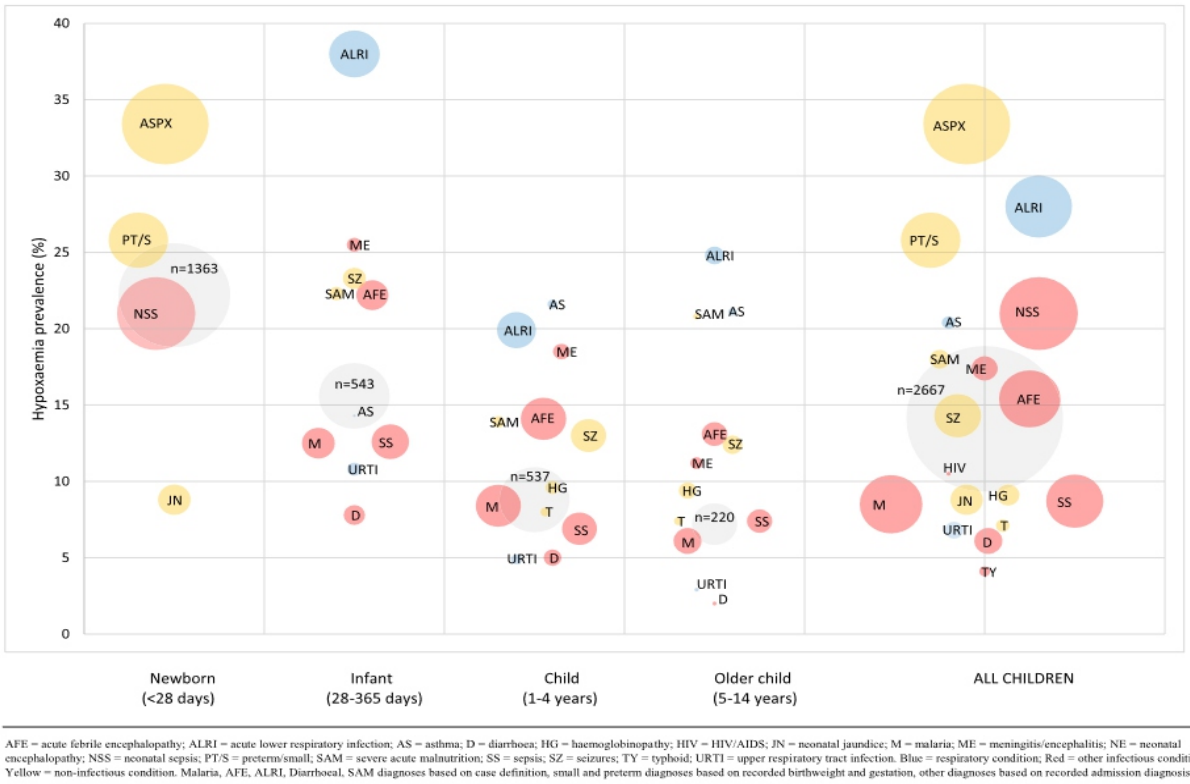
[2] Ayobami A Bakare, Hamish Graham, Adejumoke I Ayede, David Peel, Olatayo Olatinwo, Oladapo B Oyewole, Kayode R Fowobaje, Shamim Qazi, Rasa Izadnegahdar, Trevor Duke, Adegoke G Falade, Providing oxygen to children and newborns: a multi-faceted technical and clinical assessment of oxygen access and oxygen use in secondary-level hospitals in southwest Nigeria, *International Health*, Volume 12, Issue 1, January 2020, Pages 60–68, https://doi.org/10.1093/inthealth/ihz009

The National Strategy for the Scale-up of Medical Oxygen in Health Facilities provides the framework to guide the implementation and coordination of oxygen activities in Nigeria, provides cost estimates for implementation, and is intended to support resource mobilization efforts. The Federal Ministry of Health (FMOH) is committed to working with state governments, health facilities, and relevant stakeholders – relevant MDAs, regulatory agencies, professional boards and training institutions, donor and other partners - to make oxygen access a key priority and ultimately, improve oxygen access in Nigeria.

CHAPTER 1
BACKGROUND

1.0 Hypoxaemia

Hypoxaemia, referred to as low levels of oxygen in the blood [3] is a life-threatening complication of respiratory infection, preterm birth, surgery, and many disease conditions in children and adults such as severe pneumonia, sepsis, meningitis, acute asthma, birth asphyxia, and chronic obstructive pulmonary disease (COPD) and severe acute respiratory syndrome (SARS[4]). Hypoxaemia may also occur during therapeutic and invasive processes like anaesthesia, surgical and obstetrics care. When not detected and treated promptly, there is an increased risk of death especially in neonates, children, and the elderly. While it is estimated that over 120,000 children die from hypoxaemia each year in Nigeria, there is limited data on fatality rates in the adult population.



AFE = acute febrile encephalopathy; ALRI = acute lower respiratory infection; AS = asthma; D = diarrhoea; HG = haemoglobinopathy; HIV = HIV/AIDS; JN = neonatal jaundice; M = malaria; ME = meningitis/encephalitis; NE = neonatal encephalopathy; NSS = neonatal sepsis; PT/S = preterm/small; SAM = severe acute malnutrition; SS = sepsis; SZ = seizures; TY = typhoid; URTI = upper respiratory tract infection. Blue = respiratory condition; Red = other infectious condition; Yellow = non-infectious condition. Malaria, AFE, ALRI, Diarrhoeal, SAM diagnoses based on case definition, small and preterm diagnoses based on recorded birthweight and gestation, other diagnoses based on recorded admission diagnosis.

FIGURE 1: HYPOXEMIA BURDEN

Prompt diagnosis of hypoxaemia is critical to care. Pulse oximeters are recommended for use in measuring oxygen saturation (SpO_2). Oxygen is the recommended therapy for the management of

[3] Fashanu, C. *et al.* Improved oxygen systems at hospitals in three Nigerian states: An implementation research study. *Pediatr Pulmonol* **55**, S65–S77 (2020).

[4] Duke T, Subhi R, Peel D, Frey B. Pulse oximetry: technology to reduce child mortality in developing countries. Ann Trop Paediatr. 2009 Sep;29(3):165-75. doi: 10.1179/027249309X12467994190011. PMID: 19689857.

hypoxaemia and unlike other medical conditions, there are no clinical substitutes or alternatives for treatment of hypoxaemia. When detected, all patients with hypoxaemia should be treated with medical oxygen.

1.1 Oxygen as an Essential Medicine

Oxygen is an essential drug included on the WHO essential medicines list (EML), [5]with indications for use in newborn and child health care, obstetrics and gynaecology, anaesthetic, and surgical services. It is also a highly cost-effective treatment for patients with hypoxaemia and other co-morbidities. A cost-effectiveness study conducted in Nigeria reported an estimated 5-year cost effectiveness of USD86 per patient treated, USD 2,694 to 4,382 per life saved and USD82-125 per disability-adjusted life year-averted comparable to other life-saving interventions[6]. While this essential medical commodity is readily available in upper-income countries, oxygen is often unavailable in lower-income countries where medical institutions lack the comprehensive systems required to deliver medical oxygen. Maintaining a supply of medical oxygen as an essential drug requires special procurement, storage, distribution, administration, and overall management of a functional system to ensure its availability.

1.2 Oxygen use cases

There are a variety of oxygen use-cases that are relevant across all levels of the health care systems – from primary to tertiary health care levels and some of these include:

- Surgery/Obstetrics and Gynaecology

Nigeria has a high maternal mortality ratio (MMR) at 512 deaths per 100,000 live births. [7]Many obstetric conditions (obstetric shock including haemorrhagic, anaphylactic shock and septic shock, preeclampsia and eclampsia, and caesarean sections) and gynaecological conditions (comprehensive abortion care and postabortion care complications, ectopic pregnancy, and fistula) require the use of oxygen. For women in labour and delivery in low and middle-income countries, obstetric emergencies such as haemorrhage, pulmonary embolism, and eclampsia with hypoxaemia may go undiagnosed Having the means to detect hypoxaemia (e.g., pulse oximetry) and to manage hypoxaemia is critical in preventing maternal deaths.

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[5] WHO Model Essential List, 2019. https://apps.who.int/iris/rest/bitstreams/1237479/retrieve

[6] Graham HR, Bakare AA, Ayede AI, Eleyinmi J, Olatunde O, Bakare OR, Edunwale B, Neal EFG, Qazi S, McPake B, Peel D, Gray AZ, Duke T, Falade AG. Cost -effectiveness and sustainability of improved hospital oxygen systems in Nigeria. BMJ Glob Health. 2022 Aug;7(8):e009278. doi: 10.1136/bmjgh-2022-009278. PMID: 35948344; PMCID: PMC9379491.

[7] National Population Commission (NPC) [Nigeria] and ICF. Nigeria Demographic and Health Survey 2018. Abuja, Nigeria and Rockville, Maryland: NPC and ICF; 2019

Patients in perioperative care are at greater risk of hypoxaemia due to airway manipulations and obstruction, inadequate breathing, drug reactions and equipment failure. Supplemental oxygen may be required during and after anaesthesia to counteract possible cardio-respiratory depression. The management of both emergency and chronic conditions require surgical interventions with a pure source of oxygen at the time of operation and post-surgery in the recovery or Intensive Care Units (ICUs).

- Oxygen Therapy for Newborn and Child Health

Pneumonia is the leading cause of death in children under 5 years of age and is responsible for an estimated 14% of all deaths in this age category[8]. Hypoxaemia is a major fatal complication of pneumonia, and the risk of death increases with increasing severity of hypoxaemia. A 2019 study in Nigeria found that for a range of primary diagnoses (pneumonia, malaria, preterm birth, neonatal encephalopathy, neonatal sepsis), hypoxemia increases the odds of death by six times in neonates and by seven times in children[9]. More than half of all neonatal deaths globally are due to severe respiratory distress syndrome as a complication from pre-term birth, neonatal pneumonia, and asphyxia, all of which can cause low blood oxygen. (WHO,2019) [10]

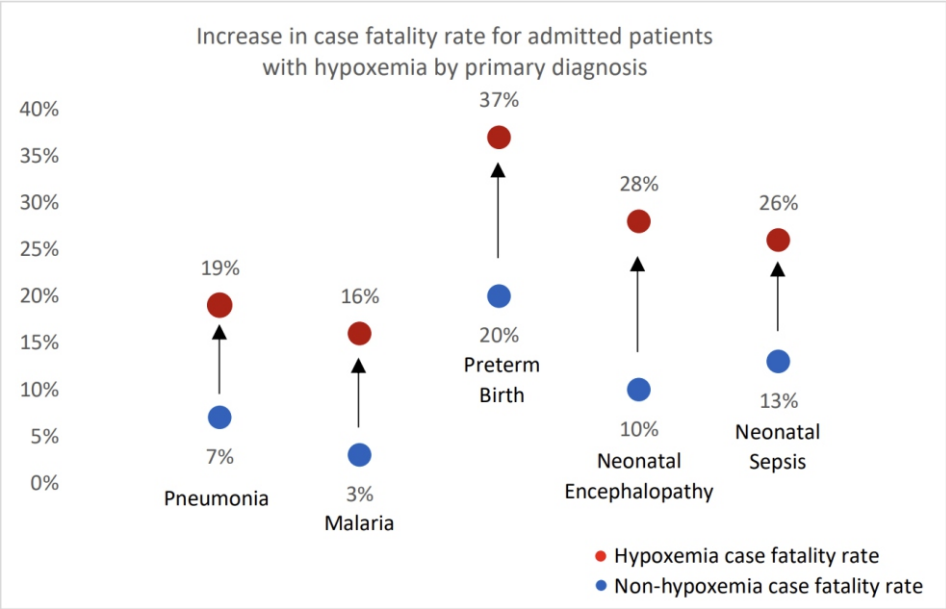


FIGURE 2: HYPOXAEMIA AND ODDS OF DEATH (GRAHAM ET AL, 2019)

[8] Pneumonia in Children. Retrieved from WHO fact sheet, 2022. https://www.who.int/news-room/fact-sheets/detail/pneumonia

[9] Graham, H. *et al.* Hypoxaemia in hospitalised children and neonates: A prospective cohort study in Nigerian secondary-level hospitals. *EClinicalMedicine* **16**, 51–63 (2019).

[10] Newborns: Improving survival and wellbeing. Retrieved from WHO fact sheet, 2020. https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality.

- General Emergency care

Oxygen therapy is required as a basic lifesaving intervention in acutely ill and injured patients. Patients of all ages with surgical, medical, and obstetrics emergencies including injuries and infections, heart attacks and strokes, asthma and acute complication of pregnancy may all require oxygen for resuscitation even before any attempt is made to diagnose the underlying injury or condition. Treatment of hypoxaemia in these cases is vital to prevent secondary brain damage.

- Disease management

Hypoxaemia prevalence and associated disease conditions vary by age group. In neonates and children, conditions such as prematurity, birth asphyxia, sepsis, lower respiratory tract infections (e.g., pneumonia), severe malaria, malnutrition and meningitis may be complicated by hypoxaemia. In adults however, chronic obstructive pulmonary disease (COPD), acute asthma, pneumonia, heart failure, cerebrovascular accidents, and acute respiratory diseases such SARIs (e.g. COVID-19) are the predominant causes of hypoxaemia.

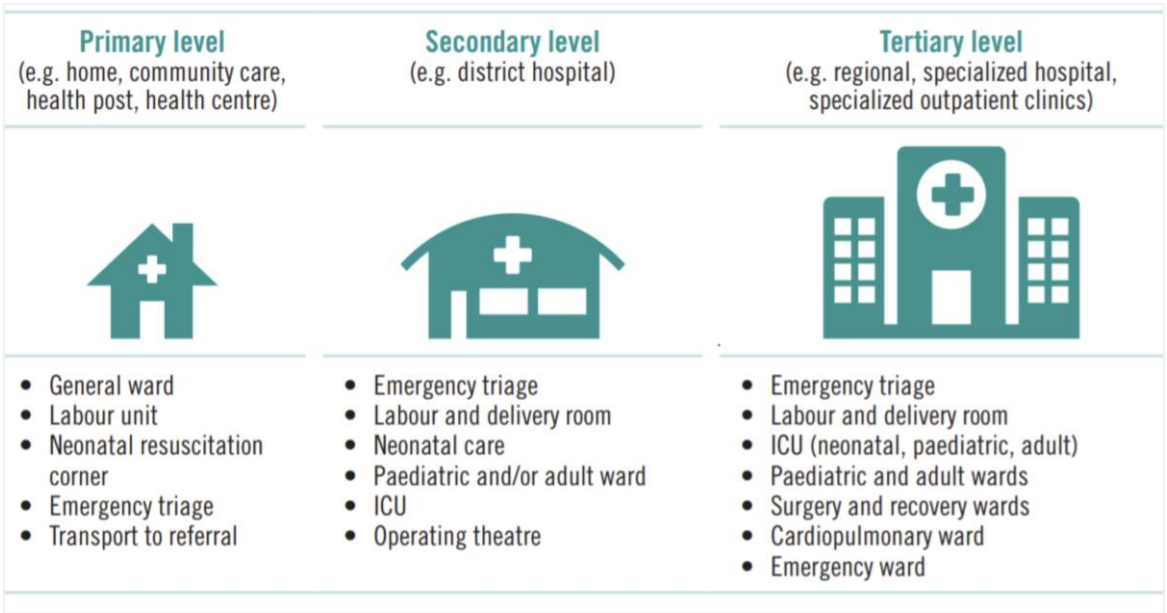


FIGURE 3: OXYGEN USE ACROSS DIFFERENT LEVELS OF THE HEALTH CARE SYSTEM - ADAPTED FROM WHO [11]

1.3 Medical oxygen and the COVID-19 Pandemic

The COVID-19 pandemic exposed the alarming gap in the availability of medical oxygen globally. Weak, unreliable medical oxygen systems can be a critical bottleneck in pandemic response efforts.

[11] Use of Medical Oxygen {Internet, WHO} (https://www.who.int/health-topics/oxygen#tab=tab_1.)

COVID-19 patients imposed even more pressure on the already weak supply systems for medical oxygen in most LMICs, including Nigeria.

In response to the gaps highlighted by the COVID-19 pandemic, international donor agencies, the private sector and country governments have made significant short- to long-term investments in medical oxygen provision, including supply of oxygen concentrators and medical oxygen in cylinders, installation of pressure swing adsorption (PSA) plants, procurement of liquid oxygen tanks and consumables. There are also ongoing efforts to strengthen government coordination and capacity to properly manage these investments at national and sub-national levels. Additionally, there have been commitments and investments in capacity building for critical health care workers (HCWs) on COVID-19 case management and hypoxaemia management, as well as training of biomedical engineers and technicians to improve equipment maintenance and lifespan.

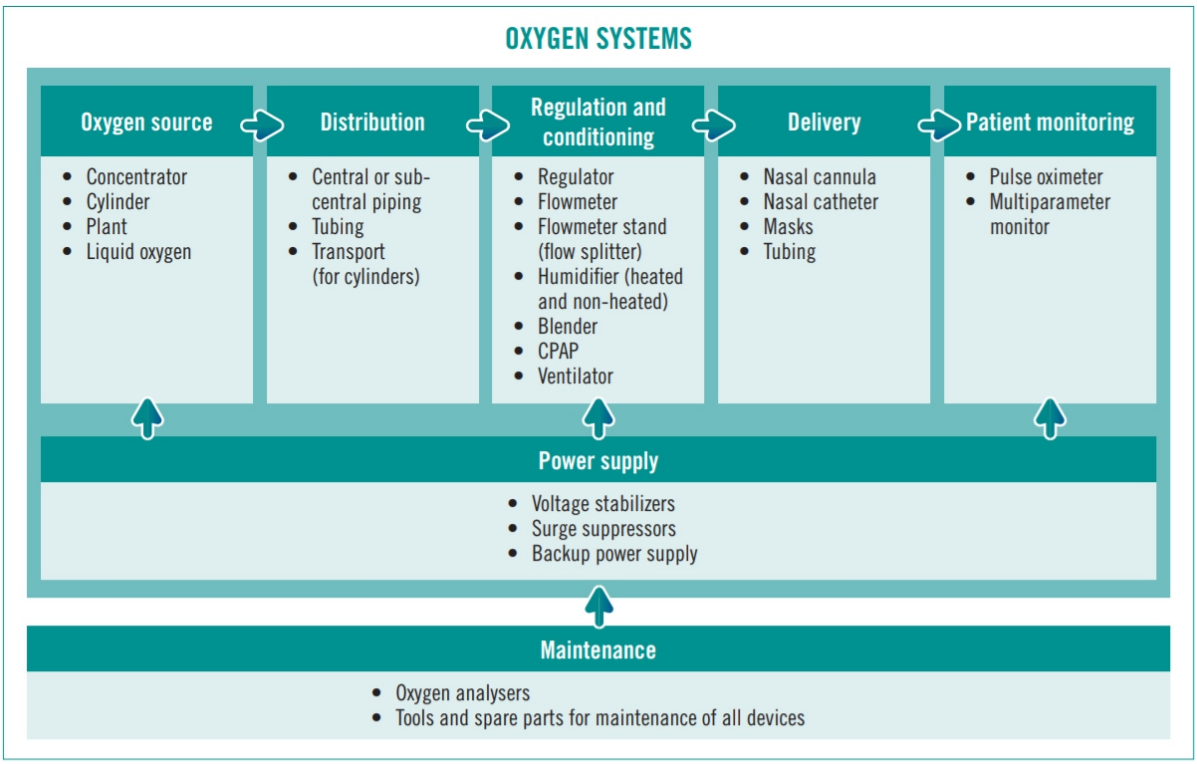
It is unlikely that COVID-19 will be the last global pandemic to happen. Severely ill patients, especially those with highly contagious respiratory conditions, will need oxygen. As pollution and climate change continue to negatively impact health, the burden of respiratory illness will also continue to grow. Nevertheless, the COVID-19 pandemic offers an invaluable opportunity to address these existing problems. To recover from the impact of the pandemic, build resilient and robust health systems, and prepare for the next global health crisis, investments in sustainable medical oxygen systems is critical.

1.4 Components of an efficient medical oxygen system

Ensuring equitable access and availability of medical oxygen at the facility level for clinical care requires the design and continuous maintenance of an efficient medical oxygen system. According to the WHO, an oxygen system refers to the entire framework through which medical oxygen is produced, distributed, regulated, conditioned, and delivered for safe patient use. [12] In establishing an effective medical oxygen system, key consideration includes – human resource for health, training, financing, maintenance, power supply etc.

Administration of medical oxygen at point of care requires a source (such as oxygen cylinders, concentrators or a central source via pressure swing adsorption plant or liquid oxygen tank) and a delivery device (such as nasal prongs, face masks and tubing) as presented in ***Figure 4***.

[12] https://www.who.int/teams/health-product-policy-and-standards/assistive-and-medical-technology/medical-devices/oxygen



[13]**FIGURE 4: COMPONENTS OF OXYGEN SYSTEMS**

There are three main models of medical oxygen production: Concentrators, Pressure Swing Adsorption (PSA) and Air Separation Unit (ASU) or Cryogenic plants (***Figure 4***). These models concentrate oxygen to recommended purity level from ambient air. Concentrators and PSA plants produce medical oxygen in gaseous form while ASU produces liquid oxygen usually stored in cryogenic tanks. Ownership of these models across the country vary: government-owned, private, and public-private partnerships. In planning for the appropriate mix of medical oxygen sources, factors such as availability of human resources, health facility infrastructure (e.g. power supply) and geography must be considered as summarized in ***Table 1.***

[13] Figure 4: WHO-UNICEF technical specifications and guidance for oxygen therapy devices

TABLE 1: COMPARISON OF THE VARIOUS OXYGEN SOURCES

Common Oxygen source	Oxygen Cylinders	Oxygen Concentrators	Pressure Swing Adsorption (PSA) Plants	Liquid Oxygen (LOX) Tank
				
Description	**Oxygen cylinders** are high-pressure portable cannisters used to store and ship compressed or liquid medical gases under varying pressures. Cylinders are available in variety of sizes and are most commonly made of steel but can also be made of aluminium or carbon fibre. There are two types of cylinders. Gas cylinders for compressed gas and Liquid cylinders for cryogenic liquid medical oxygen.	**Oxygen Concentrators** are self-contained medical devices that produce medical grade oxygen. A concentrator filters surrounding air, compressing it to the required density and then delivers purified beside medical grade oxygen using PSA technology	**Pressure Swing Adsorption (PSA) Plant** is a unit (onsite or offsite) designed to concentrate oxygen from ambient air at scale. Oxygen can either be piped directly from the oxygen tank to wards, or further compressed to fill cylinders via a supplemental booster compressor and a cylinder filling ramp/manifold.	**Liquid oxygen (LOX)** is produced in large volumes by Cryogenic Air Separation Units often located offsite away from health facilities. LOX is transported onsite to periodically fill large bulk liquid oxygen tanks by a supplier. From its liquid state, oxygen can then be vaporized and delivered to patients via piped walls.
Case for use	Used at health facilities in regions with poor power supply coverage or facilities with access to bulk sources but low-to-average volumes of consumption. Used at patient's bedside or piped via a distribution manifold. Used as a backup for other oxygen system sources.	Used at low and mid-level heath facilities with reliable power supply. Used to deliver oxygen near patient's bedside.	Used in medium to large health facilities with adequate power supply, manpower and skilled technicians for ongoing operations, repair and maintenance. Can fill cylinders or be directly piped to patient wards.	Large facilities with high volume oxygen demand where transport from liquid supply is cost effective and reliable. Regional filling stations serving multiple health facilities, accessible to liquid supply. (Within reasonable supply distance)

Advantages	Less technical capacity to use. Does not require power supply. Can be easily gauged and monitored	Low running cost after initial investment Very portable and easily moved. Can be used in any setting where other sources can't e.g., wards, homes, ICU etc. Can serve up to 4 patients/1 Unit	Most cost effective for larger facilities. Produces high volume oxygen per unit and surplus oxygen generated can be used by nearby health facilities. Available in many sizes and configurations to meet most medical needs	Liquid can be stored more cost effectively. The storage capacity is large (1 Litre of LOX expands to 861 Litres of gaseous oxygen). Minimal dependency on power supply as vaporization of liquid to gas requires no power.
Disadvantages	Logistics costs are expensive. Could be hazardous if not properly maintained. Loss and pilferage of cylinders	Does not store oxygen, relies heavily on power availability and requires stable and uninterrupted power supply High air humidity can reduce operating capacity Requires consistent maintenance & repairs and supply of spare parts. Consumables and spare parts are usually brand specific	Requires significant power for use. Expensive to procure. Requires skilled manpower. High cost of maintenance	Supplier dependent Expensive to procure. Requires skilled manpower. High cost of maintenance

1.5 Country Profile

Nigeria is a West African country with an estimated population of 200 million (based on projections from the 2006 Census conducted by the National Population Commission) and a land mass of 923,768 km^2. It is the most populous country in Africa and the largest black nation in the world. Nigeria borders Benin, Niger, Cameroon, Chad, and the Atlantic Ocean. The country operates a three-tier federal system of governance and a bi-cameral legislature. The Federation is made up of the Federal government, the 36 states and the Federal Capital Territory (FCT), and the 774 Local Governments Areas (LGAs). Each tier of government has some responsibility for healthcare delivery and management.

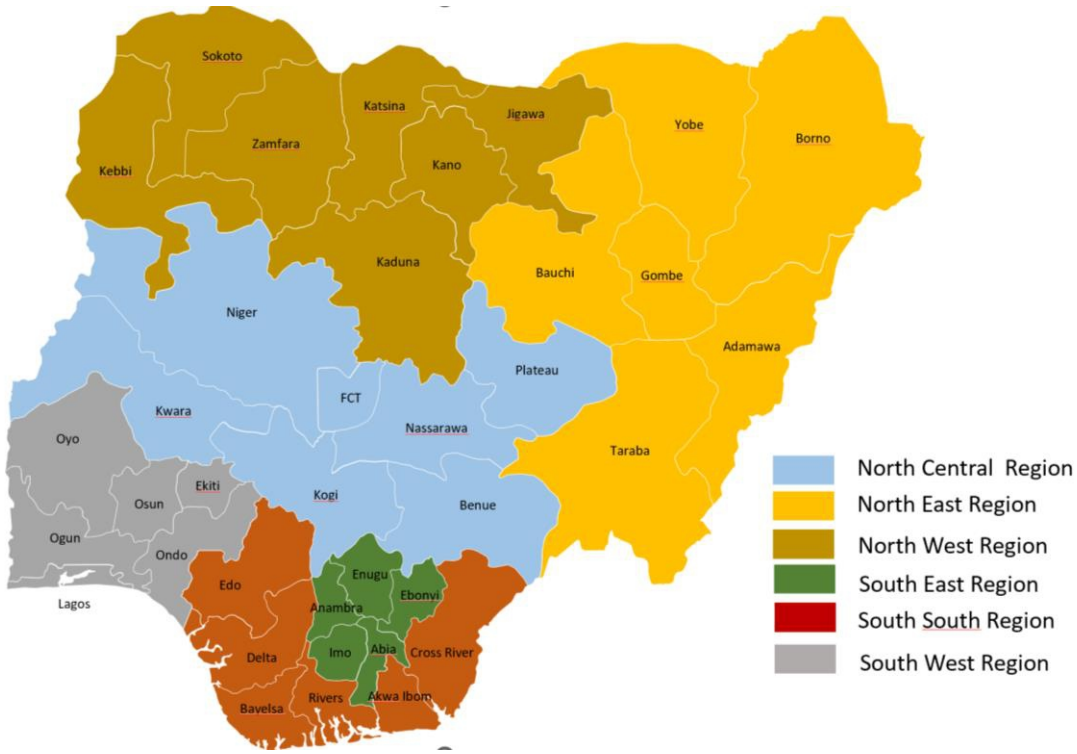


FIGURE 5: MAP OF NIGERIA

According to the 1999 Constitution as amended, health care provision is the mutual responsibility of the three tiers of Government. The Federal Government is responsible for tertiary healthcare and development of policies through the FMoH. The FMoH coordinates and leads public health programmes, planning and implementation. The state governments through the state ministries of health (SMoHs) are responsible for provision of secondary healthcare through the state general hospitals and may provide tertiary care through state-owned tertiary teaching hospitals. The states also coordinate primary level of care through the State Primary Health Care Development Agencies (SPHCDAs) and State Primary Health Care Management Boards (SPHCMBs). The local governments are also responsible for the provision of primary health care services. In Nigeria, the private health sector is also a heavily utilized and important source of care, providing varying levels of care from primary through to specialised tertiary-level services. The state governments provide regulatory oversight for private sector activities.

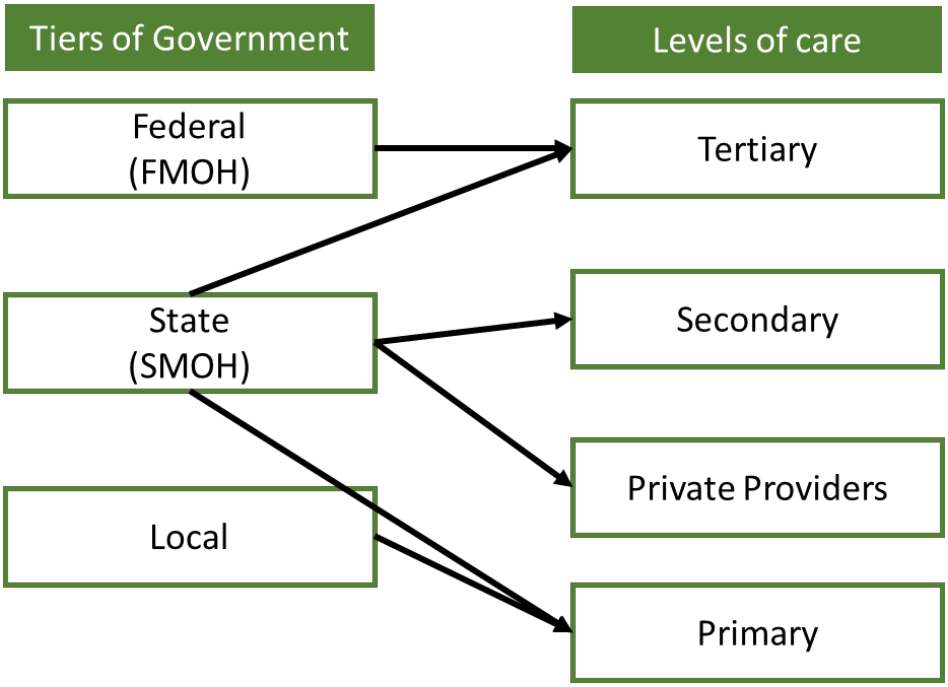


FIGURE 6: HEALTH SYSTEM STRUCTURE IN NIGERIA

The ministries of health at the federal and state levels are headed by the Honourable Minister and Commissioners respectively, and they provide strategic guidance and support for the implementation for the strategies at all levels. Different departments and agencies are tasked with implementation of various interventions, disease, or programme areas. The Department of Hospital Services of the Federal Ministry of Health coordinates all interventions for medical oxygen and medical oxygen systems in the country, providing strategic guidance to the government, partners, and stakeholders in the oxygen landscape.

Access to and coverage of health care services is fraught with challenges; about 97% of Nigerians are not covered by any form of health insurance or pre-paid financing mechanisms[14]. Therefore, out-of-pocket expenditure accounts for approximately two-thirds of total health expenditure in the country resulting in unequitable access and the risk of catastrophic and impoverishing health expenditure for a vast majority of the population.[12]

[14] National Population Commission (NPC) [Nigeria] and ICF. Nigeria Demographic and Health Survey 2018. Abuja, Nigeria and Rockville, Maryland: NPC and ICF; 2019

CHAPTER 2
METHODOLOGY

2.0 Rationale for review of the strategy

The maiden edition of the strategy document launched in 2017 had a 5-year validity period (2017-2022). Since the inception of this strategy, the medical oxygen landscape has experienced significant changes largely owing to the advent of the COVID-19 pandemic in 2019. Several lessons were learnt which demand the update and expansion of the scope of the existing strategy to accommodate public health and respiratory care emergencies and to respond to current realities and exigencies for medical oxygen use.

2.1 Review process for the National Strategy for Medical Oxygen (2023-2027)

The Federal Ministry of Health, through the United for Oxygen (U4O) coalition, led the revision of the National Oxygen strategy with support from donors and partners such as the Clinton Health Access Initiative (CHAI), FHI-360, Save the Children, World Health Organization (WHO) and UNICEF. The process officially kicked off in July 2022, and comprised of desk reviews, physical and virtual workshops and meetings convened by the FMoH with support from U4O partners. Stakeholders' participation cut across the public sector, clinicians, academicians, private sector, Non- Governmental Organizations (NGOs), and Ministries, Departments and Agencies (MDAs). Data presented in this document were collated from National assessments supported by various partners and stakeholders across the country. The revised document was validated in December 2022 and received formal approval from the Honourable Minister in January 2023.

2.2 Guiding Principles for the Development of the Strategy

In developing the strategy, a multi-sectoral, multi-stakeholder approach was prioritized. This included consultations with key actors from both the public and private sectors and adoption of a human-centred approach to ensure that the revised strategy would provide a veritable roadmap to meet the needs of all citizens. To achieve this, several guiding principles underpinned the development of the strategy and will, in the future, form the foundation for strong systems for oxygen access in Nigeria and help drive impact across all strategic priorities. These principles include:

- **Equity considerations**: Ensure all people in Nigeria – with a focus on children under-5, women, as well as hard-to-reach, vulnerable, and disadvantaged populations – benefit from improved efforts to ensure equitable access to oxygen in the management of hypoxaemia.
- **Inclusive and strategic partnerships**: Successful implementation of this strategy will depend on establishing platforms that engage with and include a broad range of perspectives, skills, resources and experience Therefore, considerations for inclusiveness and partnerships with strategic stakeholders - MDAs, partners, private sectors and communities amongst others - will be a strong guiding principle in the implementation of this strategy.
- **Evidence-based practices:** The strategy development was informed by data driven considerations through consolidating information from National assessments and stakeholders' experience and, in the implementation of the strategy, improved access to data and information on Oxygen – both for supply and demand – that can be analysed and used to inform resourcing, strengthen interventions and activities and course correct will be inimical to improving access to oxygen in a cost-efficient and equitable way.
- **Integration:** Ensuring that as much as possible, all recommended interventions and activities integrate into existing, related, and relevant public health programmes across all levels of care with a special focus on child and maternal health programs as well as other emergency and pandemic preparedness programs – amongst others. This integrated approach requires close coordination across government programs and levels, partners, and sectors to fully leverage existing programs, platforms, and resources rather than creating oxygen-specific programming. This is more relevant given the cross-cutting nature of hypoxaemia and oxygen need.
- **Performance Tracking and Accountability:** Strategic objectives for this strategy were set to be SMART – Specific, Measurable, Attainable, Realistic and Timebound relying on baseline estimates from national assessments. These will be assessed using the key performance indicators (KPIs) in the monitoring and evaluation framework while spelling out roles and responsibilities and an accountability framework for performance tracking and management.
- **Optimizing investments:** Optimizing current and pipeline investments in Oxygen systems will improve efficiency and translate reliable and consistent availability and use. Therefore, considerations around maximizing current investments and ongoing efforts in the medical oxygen landscape to support resilient structures for the implementation of the strategies have been done.

- **Sustainability:** Considerations around sustainable funding, equipment maintenance and human capital development for the implementation of strategy have been used in the development of the strategy and will be relevant throughout implementation of the roadmap.

CHAPTER 3
SITUATIONAL ANALYSIS

3.1 Historical perspective and implementation status of the first National Strategy on Medical Oxygen

In 2017, the FMoH in collaboration with development agencies and partners developed the first *National Strategy and Policy for the Scale up of Medical Oxygen in Health Facilities* in response to increasing morbidity and mortality from hypoxaemia especially in children under five. Since then, the government has shown increased interest and made investments in medical oxygen systems. In the same year, a coalition of stakeholders including the FMoH, partners, academia and private sector was formed to increase access to medical oxygen and pulse oximetry in Nigerian health facilities and to support the implementation of the maiden strategy. Using the strategic roadmap as a framework for implementation, the FMoH and partners have played crucial roles in bridging gaps in the medical oxygen landscape through capacity building, equipment donation, infrastructural upgrades, and assessments to generate evidence for better decision making at all levels.

The COVID-19 pandemic provided a unique opportunity to refocus attention on oxygen, finance and drive implementation of the current National Strategy at national and sub-national levels. Key successes recorded from the implementation include the establishment of oxygen coordination platforms at sub-national levels, procurement of oxygen commodities and consumables to meet demand, conduct of rapid assessments and national quantification exercises to guide procurement and equitable distribution of equipment, identification of domestic financing models and sources of medical oxygen, and increased awareness on the pivotal role of medical oxygen as an Essential Medicine.

In addition, the strategy and existing coordinating platforms served as a framework to support the country's respiratory care support response for the COVID-19 pandemic through improved coordination, availability of clinical guidelines and provider training modules and curricula. It also helped to support equitable distribution of medical oxygen supplies (tanks, plants, and cylinders) from multiple sources (government and partners) across the country. Despite these achievements, appraisal by the FMoH and the United for Oxygen (U4O) stakeholders identified gaps in implementation of the maiden strategy (see ***Table 2)***.

TABLE 2: IMPLEMENTATION GAPS FOR NATIONAL OXYGEN STRATEGY (2017 – 2022)

Thematic area	Implementation gaps
Enabling environment *Low adoption and prioritization of the strategy and key interventions as well as inadequate financing mechanisms results in oxygen scarcity and high prices*	• Inadequate dissemination of the strategy document at National and sub-national levels resulted in poor adoption of the strategy especially at the sub-national levels. • Weak coordination structures at the sub-national level resulted in very limited adoption of and sub-optimal implementation of key interventions in the strategy. • The current strategy lacked a well-defined resource mobilization strategy to support implementation activities. • Low prioritization, inadequate funding, and budgeting for implementation of the strategy leads to oxygen scarcity and high prices often times restricting usage to a few patients who can pay high out-of-pocket costs for oxygen. • Gaps in integrating the strategy into existing financing models and other public health programs at National and Sub-national levels.
Supply and Maintenance *Low investments in oxygen systems and lack of coordination across the business eco-systems and drove limited supply, high prices and weak maintenance services*	• Minimum standards and technical requirements for products were not defined or clearly articulated in the current strategy nor were SOPs to guide procurement decisions at National and sub-national levels developed. This resulted in a proliferation of sub-standard equipment and products in the country. • Failure to define appropriate types of oxygen production operating models and PPP structures including mechanisms for aggregating demand, defining equipment maintenance services mechanisms etc. • Failure to comprehensively address human resource gaps – particularly for Biomedical Engineers and Technicians (BME/Ts) and in-system capacity for equipment use, maintenance, and repair
Provider and patients *Low health care workers capacity without clear guidelines or basic tools, result in low uptake of oxygen*	• Lack of guidelines, standard operating principles (SOPs) and job aids for clinical staff on hypoxaemia management and the use of medical oxygen – especially at service delivery points where the need is greatest. • Lack of oxygen-related education in many health training programs • Lack of oxygen-related auditing or program monitoring as well as inclusion in appropriate clinical quality and performance improvement frameworks and platforms • Poor coordination and integration for BME/Ts within the health workforce.
Information and data management	• Inadequate clinical data hampers the quality and availability of oxygen-related services. Specifically, the failure to include oxygen and hypoxaemia indicators in

Lack of quality data constrains appropriate planning, budgeting, and clinal quality improvements	the national health management information system – the Demographic and health information system (DHIS) • Lack of electronic inventory systems to track oxygen supply (financial, supply availability, consumption etc.) in the country limits capacity to plan and make informed budgetary and allocative decisions

Lessons Learnt from Implementation of Strategy

- Need to develop a fully costed dissemination plan to improve adoption and implementation at all levels.
- Integration of the implementation plan into existing structures, programs, and financing platforms will promote scale-up, coverage and increase sustainability.
- Conducting and using data from assessments to inform gap estimates and demand quantifications increases the robustness of the roadmap.
- A well-defined and articulated resource mapping and resource mobilization strategy is a first step in ensuring that key interventions in the strategy are funded and implemented.
- The existence of a central coordinating body for oxygen (U4O) was pivotal in the country's COVID-19 pandemic response and establishing similar platforms at the sub-national level is equally as important.
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3.2 Oxygen Coordinating Structures

A National multi-stakeholder coordinating forum (United for Oxygen or U4O) was established in 2017, chaired by the Oxygen Desk of the Department of Hospital Services of the Federal Ministry of Health. The U4O platform was set up to align approaches and provide strategic guidance to government, donors and partners implementing medical oxygen-related interventions at national and sub-national levels. At the peak of the COVID-19 pandemic, this forum proactively supported government to coordinate resources and efforts for efficient delivery and in response to the increased demand for medical oxygen across the country. The U4O coalition includes stakeholders across public and private sectors: – Non-Governmental Organizations (NGOs), Implementing partners, academia, Civil Society Organisations (CSOs), Donors etc. *(See Annex F for stakeholders and groups)*. The U4O coalition works closely and collaborates with other global coordinating platforms like Every Breath Counts (EBC) coalition.

The FMoH Oxygen Desk maintains a national database to map and coordinate oxygen interventions and investments. Through this, the country can avoid duplication of efforts, plan for and execute on plans for a more equitable and efficient distribution of resources across the country. This proved to be useful at the peak of the pandemic when the country witnessed an influx of resources. Through this, more efficient allocation of resources and medical oxygen equipment were made. While the U4O

served as a platform for the FMoH to collaborate and work with partners on strengthening the country's medical oxygen system, the pandemic exposed the need to replicate similar coordinating platforms at sub-national level. Before 2021, there were no existing coordination platforms or desks responsible for the management of medical oxygen systems at state ministries of health. These gaps resulted in poorly coordinated inventory, poor visibility of oxygen delivery services and management of resources. With guidance and support from partners, oxygen desks have been established in 34 states to date, with coordinating fora inaugurated in 16 of these states with clear terms of reference (*See Annex C*). These state coordinating platforms have been linked to the national Oxygen Desk for effective coordination and guidance to support effective and impactful oxygen programming in the respective states.

3.3 Financing Oxygen

All publicly owned medical oxygen equipment and technologies in the country such as PSA plants, Cylinders, Concentrators etc. have been procured by the Federal and State ministries or by donor funding agencies. Medical oxygen is currently not prioritized in funding mechanisms at sub-national level and is not represented in many health plans or budgets. Prior to 2021, there was little advocacy for oxygen scale-up nor its prioritization at national and sub-national levels. Few policy makers or advocacy groups understand the need or the clear gap in medical oxygen systems in the country and are therefore unable to advocate for or make decisions that prioritize its investments. This has resulted in poor financing for medical oxygen services and failure to include in national and sub-national health plans and budgets. Although oxygen is listed as an essential medicine by the WHO and is also included in the National Essential Medicines List (EML), many financing mechanisms and platforms like the Global Financing Facility (GFF) and the Basic Health Care Provision Fund (BHCPF) have historically failed to prioritise or make provisions for medical oxygen in their investments case. Furthermore, medical oxygen is not explicitly included in most benefits packages including Reproductive Maternal Newborn Child and Adolescent Health (RMNCAH + N) services resulting in exorbitant out of pocket expenditure for the lifesaving commodity. In many settings in the country, patients face charges of more than NGN18,000 (USD 38.8) for one 6,800L sized cylinder supply of oxygen. This is further exacerbated by the fact that there are no standardized costings or normative guidance for how medical oxygen services should be charged to patients.

In few instances, facilities across the state have partnered with private sector players and financing systems to sustain supply of medical oxygen through various PPP arrangements. However, the highly decentralized nature of the health system and fragmented nature of demand and financing means that

oxygen supply is poorly coordinated, markets and suppliers are often unable to respond to fragmented demand, therefore limiting strategic procurement mechanisms to allow for better product selection.

It is evident that a strong investment case for medical oxygen access has to be developed and put forward to all tiers of government and policymakers to elevate its importance and increase prioritization. In addition, to improve sustainability of new investments, innovative financing and operating models need to be explored for the procurement and management of medical oxygen systems from production to supply and distribution.

3.4 Human Resources for Oxygen

There is a dearth of human resource capacity both for the delivery of medical oxygen and for the maintenance of medical oxygen systems and associated services in the country. For service delivery, the capacity of relevant personnel and frontline health care workers for diagnosis of hypoxaemia, appropriate and rational use of oxygen and in the management of medical oxygen systems is suboptimal.

Health care workers are poorly equipped to use pulse oximetry as a diagnostic tool for hypoxaemia. There are no clearly defined clinical guidelines and job aids to support health care workers training for medical oxygen use and pulse oximetry is not included in medical or nursing curriculums nor is it integrated into continuing education or quality improvement programs. A 2022 National Assessment of oxygen systems and use in Nigeria conducted by CHAI and UNICEF showed that only 8% and 9% of nurses and doctors, respectively, have received recent training on the clinical use of oxygen and hypoxaemia case management in the country. Meanwhile, relatively modest educational support for HCWs can make a big difference to the capacity of health workers to provide oxygen therapy services to patients.

According to the WHO, 40-60% of [15]medical technologies in Africa are unserviceable[16]. From the National inventory assessment, a major cause for non-functionality of oxygen equipment across the country was poor knowledge and capacity for the maintenance of such equipment. To address this, there is a need for continuous support and prioritization of training for Biomedical engineers and technicians (BME/Ts) in the country through routine training and supportive supervision on preventive

[15] Perry L, Malkin R. Effectiveness of medical equipment donations to improve health systems: how much medical equipment is broken in the developing world? Med Biol Eng Comput. 2011;49(7):719–22. doi:10.1007/s11517-011-0786-3

[16] World Health Organization. Medical devices: Managing the Mismatch (An outcome of the Priority Medical Devices project). Geneva; 2010

maintenance and repair of oxygen equipment and technologies. BME/Ts are integral to the management of medical oxygen production systems such as management of PSA plants, piping systems, repairs of equipment etc. With the growing number of medical equipment and technologies, there is a pressing need to expand the curriculum and increase technical capacities of institutional training and learning facilities for BME/Ts in the country. BME/Ts also need to be empowered with the right tools, resources, and incentives to carry out their job functions. Tools kit boxes should be deployed across facilities to support basic repairs and maintenance checks of oxygen equipment. There are also no clear guidelines and pathways for BME/Ts coordination nationally leading to poor recognition, remuneration, inclusion, and representation of BME/Ts at the national- and state-levels as well as in facilities.

3.5 Data and Information Systems

Currently, there are no established indicators for tracking and reporting hypoxaemia management and prevalence on the National Health Management Information System (NHMIS). Patient charts and registers do not commonly include fields to record SpO_2 measurements and oxygen prescription rates. Without data on screening rates, SpO_2 measurements across patient types and oxygen administration rates, facility-level quality improvement systems lack the information needed to track and improve clinical practices: gaps in patient care are invincible – and intractable.

Also, the National Health Logistics Management Information System (NHLMIS) makes no provision for medical oxygen commodities. This gap in data availability limits data-driven decision-making on pulse oximetry use and coverage, hypoxaemia diagnosis and prevalence, oxygen therapy coverage, and preventable mortality. The disparity is also evident in the non-availability of medical oxygen consumption data across health facilities and national systems, thereby limiting insight into demand.

The targeted use of data is a well-proven intervention to improve service provision. Therefore, to effectively track medical oxygen-related data to inform planning and decision making, there is a need to develop indicators across the medical oxygen value chain. This process will involve the definition and adoption of appropriate hypoxaemia and oxygen indicators, inclusion of oxygen indicators in the NHMIS system, redesign, and deployment of revised NHMIS tools to health facilities. Additionally, this will also entail a review of oxygen supply and logistics indicators to accommodate medical oxygen commodities and consumption indicators – including availability, capacity and functionality of key oxygen equipment and technologies in the country. When achieved, this will improve the availability, visibility of and access to timely and quality data on oxygen therapy in Nigeria. Lastly, the production capacities of pressure swing adsorption (PSA) plants and liquid oxygen (LOX) available across the

country should be mapped, tracked, and monitored to inform efficient resource allocation and distribution of medical oxygen and medical oxygen use technologies.

The recent national assessment in 2022 informed the first-ever comprehensive national medical oxygen supply gap quantification. This has served as a baseline to support decision-making and to inform resource planning for this roadmap.

3.6 Medical oxygen distribution systems

The appropriate use-mix of medical oxygen supply for a given health facility depends on factors such as medical oxygen need, cost, available infrastructure, capacity and accessibility to maintenance and spare parts, supply chain for local production and distribution and availability of reliable power supply. Where present, functional PSA plants and liquid oxygen tanks significantly increase medical oxygen availability, and at scale, they are the most cost-effective of all medical oxygen supply systems. However, they are capital intensive, and their efficiency depends on a highly robust maintenance system, financing, power, LOX supply (for LOX system). In both systems, medical oxygen can be distributed patient areas through a network of pipes within the facility or through refill of cylinders.

Most health facilities in Nigeria[17] depend on cylinders[18] as the primary source of medical oxygen. [19]Cylinders can deliver medical oxygen without electricity, but they require refilling from a reliable source once depleted. Availability of medical oxygen via cylinders relies on a strong logistics and supply chain management which are either lacking or inefficient in most health facilities. Frequent refilling of cylinders requires transportation in specialized utility vehicles which can be challenging from a logistical, cost, and even security perspective thereby limiting medical oxygen supply. Very few facilities in the country have a reliable, functional, and extended medical oxygen piping systems that serves critical wards and provides bed-side oxygen to patients.

3.7 Medical oxygen equipment maintenance and Quality Assurance

Repairs and maintenance of medical oxygen equipment in health facilities are conducted by BME/Ts or other facility technicians. However, across the country, there is a short fall in the availability of BME/Ts especially within the public sector. There is sub-optimal capacity to repair and/or maintain[17]oxygen equipment due to a lack of adequate training and access to the necessary tools and

[17] Federal Ministry of Health, UNICEF and CHAI: Facility Assessment Report (available upon request)
[18] Oxygen for children and newborns in non-tertiary hospitals in South-west Nigeria: A needs assessment | African Journal of Medicine and Medical Sciences. http://ojshostng.com/index.php/ajmms/article/view/711
[19] Federal Republic of Nigeria. (2017). National Strategy for the Scale-up of Medical Oxygen in Health Facilities: 2017-2022. Abuja, Nigeria: Federal Ministry of Health.

spare parts [20]As a result, routine planned preventive maintenance is hardly done for oxygen equipment which often leads to equipment breakdown. The availability of spare parts and consumables for planned preventive maintenance (PPM) and repairs remains a challenge for the repair and maintenance [17] of medical oxygen equipment and technologies in the country leading to equipment failure and protracted oxygen shortages. This is largely driven by the following factors:

1. Supply chains for many spare parts can have prohibitive costs and long lead times
2. Lack of standard operating procedures (SOPs) or technical manuals from manufacturers to guide PPM and simple repair
3. Poor supplier networks to support replenishment of supply and consumables for facilities.

Preventive maintenance schedules and timely access to spare parts can dramatically improve the reliability and lifespan of equipment.

Some state ministries of health have rolled out BME-led equipment repair drives to conduct routine PPM and undertake repair of medical oxygen equipment and technologies at the same time developing tools, resources, and SOPs for guiding this process. This approach should be institutionalized within medical oxygen programmes in all states in the country.

It is necessary to conduct routine quality checks to ascertain that the quality of medical oxygen produced or delivered to patients are within recommended purity levels. Healthcare professionals and BME/Ts should be properly trained and equipped with the right tools such as oxygen analysers to help conduct quality checks for oxygen. However, very few facilities and SMOHs in the country have oxygen analysers to measure and monitor the quality of oxygen being produced, distributed, and delivered to patients. Facilities should also be equipped to keep records of medical oxygen purity and conditions to aid alert for the repair, servicing of existing equipment or facilities.

3.8 The role of the private sector in medical oxygen supply

The private sector is a major stakeholder in the medical oxygen landscape working with both private- and government-owned facilities to improve medical oxygen production, distribution, equipment maintenance and supply. This sector works directly or through innovative approaches such as the public-private partnership (PPP) models.

[20] Graham, H. R. *et al.* Adoption of paediatric and neonatal pulse oximetry by 12 hospitals in Nigeria: a mixed-methods realist evaluation. *BMJ Glob Health* **3**, e000812 (2018).

Major private sector players in the country include Industrial Medical Gases (IMG), Air Separation Nig. Ltd., Air Liquide, Oxygen Hub, Life Bank, etc. (*See Annex G for private sector players and suppliers and location*). The private sector has helped in several ways including: supplementing oxygen needs in public health sector through sales, delivery, installation and maintenance of oxygen and oxygen equipment in both public and private health facilities in Nigeria. The private sector continues to participate actively in National and State consultative meetings including technical working groups to contribute a sustainable medical oxygen system. However, systems and mechanisms for engaging the private sector have to be strengthened: most facilities lack the resources, volumes, and information for long-term service level agreements with private sector vendors and suppliers – impacting the *availability*, *affordability* and *reliability* of oxygen through largely weak, uncompetitive and inefficient medical gas supply landscape. These gaps can be addressed by working with the private sector to establish long-term oxygen supply partnerships and PPP platforms for a broad range of oxygen supply and facilities through coordinated, central agreements is a key intervention to improve oxygen availability quickly and dramatically. For instance, the FMOH is investing in expanding LOX storage capacity and could use this as a platform to negotiate supply and distribution partnerships for LOX supply by pooling volumes in such a way that reduces costs and aligns performance incentives across purchasers and suppliers.

3.9 Perceptions of oxygen therapy and demand

Positive perception, ability, and willingness to pay for oxygen therapy is critical to ensuring prompt and adequate treatment of hypoxaemia in health facilities. Despite its lifesaving abilities, oxygen is often refused by patients and caregivers due to unaffordability, misconceptions, and negative perceptions about its use. Preliminary findings from qualitative research in Lagos and Jigawa states supported by Save the Children's (INSPIRING Project) suggest that oxygen therapy may be refused for various reasons. In Lagos state, where oxygen is often available in government health facilities, it is not cheap, and most patients are either unable to afford it or are unable to sustain the treatment as medically necessary. In Jigawa state, patients and caregivers refused oxygen therapy due to negative past experiences, particularly those wherein adult patients or relatives died while receiving medical oxygen. Ensuring community and beneficiary perspectives are taken into account has been a key aspect in the development of this strategy and, developing appropriate community engagement strategies and resources through a human-centred approach will be inimical to broad uptake and successful implementation of the strategy.

3.10 Current Government Efforts in Oxygen Scale-Up

The FMOH has been working with different partners and stakeholders to implement the current National strategy and improve oxygen availability and coverage both at the national and sub-national levels. The COVID-19 pandemic provided opportunities for increased global investments to match rising demand for medical oxygen and a platform for further systems strengthening. Current partner efforts are summarised in ***Figure 7*** below and are highlighted in ***Annex G.***

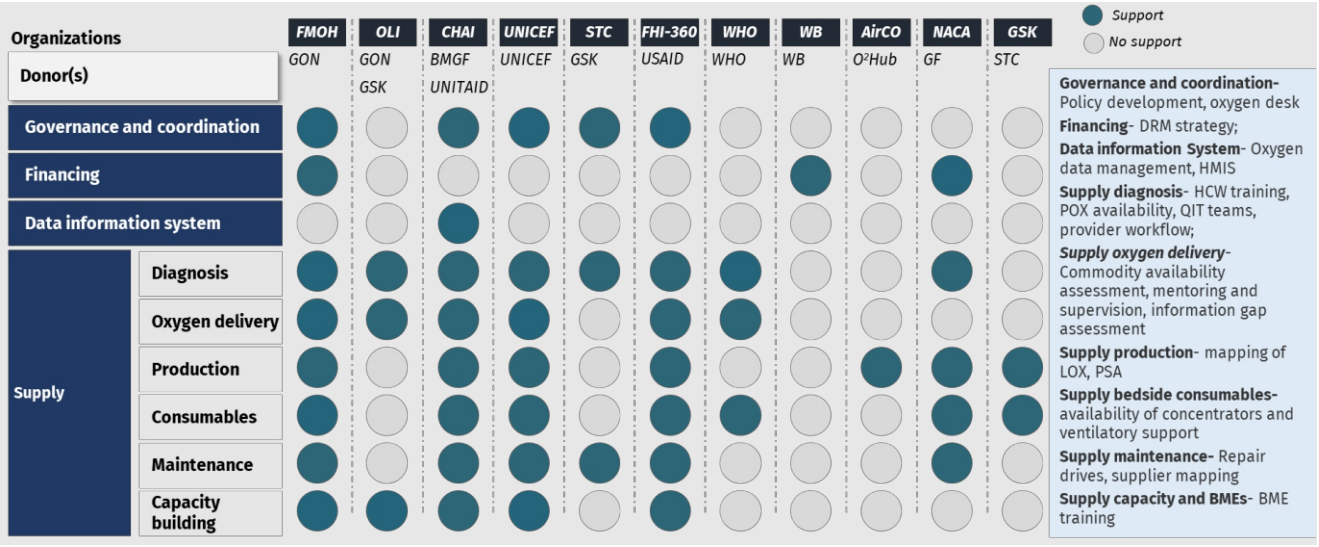


FIGURE 7: PARTNER SUPPORT ACROSS THEMATIC AREAS

3.11 Ventilators and Ventilatory capacity in Nigeria

Findings from an assessment conducted by FHI360 in August 2020 on availability of ventilators and capacity of healthcare workers for the provision of ventilatory care in tertiary hospitals in Nigeria showed that 46% of the hospitals had at least one ventilator available and functional. Of these, 41% reported availability of a functional ventilator circuit. The findings from this assessment highlights the need for additional ventilatory support across tertiary hospitals in the country including supply chain management of ventilator circuit consumables. In response to the gaps from this assessment, 200 ventilators were provided through the US government funding mechanism and distributed to tertiary hospitals. 76% of health facilities assessed with ventilators had ventilated at least one patient within two months prior to the assessment whereas 24% had no ventilations within the same period, indicating some experience and capacity for ventilation. However, there is need for additional support to fully utilize ventilators and in strengthening oxygen systems to support ventilators.

3.12 National Oxygen Assessment

With support from partners, the Federal Ministry of Health conducted the first comprehensive multi-level health facility assessment for medical oxygen therapy and deliveries in 36 states + the Federal Capital Territory (FCT). The assessment examined the availability of medical oxygen, service delivery equipment, supply infrastructure, power supply, and human resources across all levels of the health care using the Oxygen System Planning Tool (OSPT).

A total of 6,786 health facilities across different levels of care summarized below were assessed during this exercise. Health facilities were selected in collaboration with the federal and state ministries of health based on defined criteria. These criteria mainly include selection of all tertiary and secondary health facilities and all comprehensive primary health facilities providing comprehensive health care and 24-hour services as well as Primary Health Centres (PHCs) that are of strategic importance. Key findings from the assessment provide a baseline for Nigeria's medical oxygen scale-up plan and are presented in subsequent tables below.

TABLE 3: FACILITY CATEGORY (NATIONAL OXYGEN ASSESSMENTS – 2022)

Cadre of care	Rural	Peri-urban	Urban	Total (%)
Primary Health Centres (PHCs)	3,739 (76%)	519 (11%)	697 (14%)	**4,955 (73%)**
Secondary Health Facility (SHFs)	332 (43%)	186 (24%)	253 (33%)	**771 (11%)**
Tertiary Health Facility (THFs)	0 (0%)	8 (11%)	62 (89%)	**70 (0.8%)**
Specialized Hospitals	1 (50%)	0 (0%)	1 (50%)	**2 (0.03%)**
Private Hospitals	317 (32%)	157 (16%)	514 (52%)	**988 (14%)**
Total	**4,389 (65%)**	**870 (13%)**	**1,527 (23%)**	**6,786 (100%)**

Key findings from the health facility assessment are described below:

Human Resources and Clinical trainings

Trained human resources are critical to achieve patient medical oxygen delivery through adoption of best practices in hypoxaemia screening and diagnosis followed by the appropriate delivery of medical oxygen therapy. The assessment identified the number of health facilities that reported the availability of healthcare workers trained on medical oxygen therapy as shown in ***Table 4***. Only 8% of assessed health facilities reported the availability of trained nurses while only 9% of the facilities reported that medical doctors had been trained on oxygen use and hypoxaemia management.

Of the frontline healthcare workers who had been trained in the last 5 years, most of the facilities assessed provided training to nurses (30%) and doctors (28%) in the last 1-3 years (***Table 5***). Only 132 (16%) assessed public secondary and tertiary health facilities reported capacity for equipment maintenance and installation (***Table 6***).

TABLE 4: HUMAN RESOURCE CAPACITY FOR RESPIRATORY CARE IN THE LAST 5 YEARS

Cadre	No of health facility with trained personnel	Number of health facility without trained personnel	Total
Nurses	475 (8%)	5,758 (92%)	**6,233 (100%)**
Doctors	542 (9%)	5,758 (91%)	**6,232 (100%)**

TABLE 5: HCWS TRAINED IN THE LAST 5 YEARS

Cadre	Less than 1 year	1-3 years	3-5 years	Total
Nurses	75	77	69	**221**
Doctors	70	85	61	**216**

TABLE 6: HUMAN RESOURCES FOR EQUIPMENT MAINTENANCE AND INSTALLATION

	Secondary (Referral Hospital)	Tertiary (General/University Hospital)	Specialized Hospital	Total
Total number of BME/Ts	91	40	1	**132**

Diagnostic and Patient Monitoring Capacity

Pulse Oximeters

A total of 8,824 pulse oximeters available across the facilities were assessed and 77% were found to be functional (operational), while 23% were non-functional. 51% of the functional pulse oximeters assessed were fingertip pulse oximeters. (See ***Table 7***).

TABLE 7: NUMBER OF PULSE OXIMETERS AT HEALTH FACILITIES, BY FUNCTIONALITY AND TYPE

Pulse Oximeters – by type	Functional Status	PHC	SHF	THF	Specialized Hospitals	Others	Total

Table-top	Functional	309	697	388	0	37	**1,431(76%)**
	Non-Functional	175	161	114	0	10	**460 (24%)**
Hand-held	Functional	291	1,012	369	1	55	**1,728 (70%)**
	Non-Functional	429	182	102	0	12	**725 (30%)**
Fingertip	Functional	476	2,037	1,044	6	75	**3,638 (81%)**
	Non-functional	157	415	244	0	26	**842 (19%)**

Existing Medical Oxygen Supply Mixes & Production

Cylinders and concentrators are the most common oxygen sources in most health facilities in Nigeria. Some larger secondary and tertiary health facilities were designed with bedside oxygen piping systems and equipped with on-site oxygen plants with varying capacities and efficiency. Most have become redundant and inefficient due to poor maintenance practices. ***Table 8*** below shows the number of oxygen concentrators in health facilities. A total of 5,741 oxygen concentrators were identified at the time of the assessment, of which 76% were functional and 24% were non-functional. 49% of assessed concentrators have a 5L/Minute maximum capacity.

TABLE 8: NUMBER OF OXYGEN CONCENTRATORS IN HEALTH FACILITIES

Concentrator Type	Functional	Non-functional	Total
3L/Min	1,026 (76%)	323 (24%)	**1,349**
5L/Min	2,145 (77%)	642 (23%)	**2,787**
8L/Min	559 (72%)	216 (28%)	**775**
10L/Min	412 (79%)	113 (21%)	**525**
>10L/Min	216 (72%)	89 (28%)	**305**
Total	**4,358 (76%)**	**1,383 (24%)**	**5,741**

Oxygen Production – Pressure Swing Adsorption Plants

The assessment conducted between June and September 2022 identified 39 Pressure Swing Adsorption (PSA) plants in different secondary and tertiary facilities in Nigeria. Of these, 30 were assessed to be functional (operational). 22 of the functional PSAs are in tertiary hospitals while 8 are in secondary health facilities. The COVID-19 pandemic provided the opportunity for the procurement of an additional 122 PSA plants which are at different stages of procurement and installation across all geopolitical zones in the country. The Government of Nigeria procured 38 of these plants to cover 36

states with Lagos state receiving two plants, while 75 and 9 plants were procured through the Global Fund COVID-19 response mechanism (C19-RM) and UNICEF, respectively. These plants are of different production capacities as well varying operational performances.

Common reasons for non-functionality of PSA plants include the lack of spare parts for the maintenance and repairs of the plants, lack of capacity for plant management, and poor power supply. Additional plants exist in the country, but ownership lies within the private sector who operate various types of PPP-models with health facilities. Furthermore, many PSA plants provide oxygen supply to adjacent health facilities through a hub-and-spoke approach.

Liquid Oxygen Capacity

The key suppliers of Liquid oxygen (LOX) are private businesses concentrated in the southern region of the country among which are IMG and Air Liquide. These suppliers also produce other industrial gases for private businesses including bottling companies, the mining and oil sectors. However, the national assessment observed that there are only two facilities with functional LOX storage capacity:- the National Hospital Abuja (NHA) and Jos University Teaching Hospital (JUTH) with a total storage capacity of 18,000L of oxygen. Facilities currently operating the LOX system perennially experience refilling challenges with an estimated duration of 3-4weeks between order and delivery. Through the Global Fund C19-RM and the support of the United States Government through USAID, the country is expanding LOX capacity through the procurement of an additional 17 LOX tanks that will increase storage capacity from 18,000L to ~188,800L.

3.13 Quantification and gap estimates for medical oxygen need

To understand medical oxygen needs in Nigeria, a multi-facility oxygen demand quantification was conducted using data from the recent nationwide assessment led by UNICEF and CHAI. The quantification exercise aimed to inform planning for medical oxygen supply and facilitate a gap analysis of oxygen technologies, supplies and infrastructure. The recommendations from the exercise are incorporated in this revised oxygen strategy aimed at bridging oxygen systems gaps while scaling up access in Nigeria.

Methodology

Oxygen need quantification was conducted using the UNICEF's MS Excel-based Oxygen System Planning Tool (OSPT). The OSPT has 2 core outputs which were used to inform the oxygen strategy and are:

1. Theoretical demand[21] for oxygen, disaggregated by facility.
2. Equipment needs for prioritized oxygen devices and consumables, disaggregated by facility.

The approach to oxygen need quantification using the OSPT makes a variety of assumptions that are included in the model, such as:

- Number of beds, disaggregated by facility, and by ward
- Expected Hypoxaemia prevalence for each type of ward
- Average oxygen flow rate for each type of ward
- Average oxygen therapy duration for each type of ward
- Bed turnover rate, disaggregated by facility
- The inputs are used to calculate oxygen need by ward and by facility

Sample calculations for two sample hospital wards are given in Table 9 below:

TABLE 9: OXYGEN QUANTIFICATION CALCULATIONS – AN ILLUSTRATION

	Oxygen needs for one patient (L)	Number of hypoxaemic patients per year	Annual oxygen need (L)
	A	B	A x B
Neonatal ward	1 LPM* x 3 days of oxygen therapy = 4,320 L	22% Hypoxaemia prevalence x 10 beds x 50 (annual bed turnover rate) = 110 hypoxaemic patients / year	**475,200 L**
General ward	5 LPM* x 3 days of oxygen therapy = 21,600 L	3% Hypoxaemia prevalence x 10 beds x 50 (annual bed turnover rate) = 15 hypoxaemic patients / year	**324,000 L**

** Litres per Minute*

[21] Theoretical demand is the quantification of the theoretical need for oxygen, assuming all cases of hypoxaemia can be accurately diagnoses and properly treated within the constraints of the number of beds in the facility

The oxygen need quantification incorporated in this strategy considered 6,786 health facilities consisting of public primary, secondary, and tertiary health facilities as well as private and specialized hospitals in Nigeria.

Limitations

The UNICEF Oxygen System Planning Tool was selected by stakeholders in the Oxygen technical working group (TWG) as the most precise theoretical tool currently available for quantifying theoretical oxygen needs and leverages methodologies derived from a consensus amongst international experts in oxygen and hypoxaemia. Without more precise, real-time reporting of consumption, it is necessary to plan for the oxygen system strengthening by envisioning the need for oxygen. However, as with all theoretical tools, the OSPT has limitations that should be discussed in order to inform how the outputs and results are used and system monitoring should be continuously used to iteratively strengthen the country's quantification accuracy.

The tool relies on several theoretical inputs to quantify oxygen need (hypoxaemia prevalence, average flow rate, and average duration of oxygen therapy). In Nigerian health facilities, most of these indicators are not routinely monitored or reported. For the purposes of this exercise, the oxygen TWG discussed indicators based on the globally available literature, validated by in-country clinical experience. These indicators were also applied equally across all facility types, which naturally results in over or under-quantification for some facilities. Similarly, bed turnover rates were derived from facility admissions figures to determine the productivity[22] of each hospital and forecast patients in each ward. However, the figure is applied as an average across all wards. Different wards experience varied patient turnover, and the output is affected disproportionately.

While these results are suitable for determination of national and even regional level strategy, the results should be carefully reviewed against the reality in each health facility before significant, facility level decisions (such as allocation of bulk sources, infrastructure, or equipment allocation) are made.

In order to mitigate the limitations of theoretical quantification tools as well as the burden of repeated one-off assessments, the oxygen strategy in this document focuses on several activities which aim to strengthen national capacity to track consumption towards transition to a consumption-based forecasting system over time as well as real-time supply monitoring, precise cylinder distribution management and tracking and equipment inventory, requisition and management.

[22] Performance of HF with reference to admissions and discharge of patients

TABLE 10: GAP ESTIMATES FOR MEDICAL OXYGEN EQUIPMENT

Equipment	Pulse Oximeter		Concentrator		Cylinder by sizes				
Type/sizes	**Tablet op**	**Handheld**	**5 LPM**	**10 LPM**	**D (340L)**	**E (680L)**	**F (1360L)**	**G (3400L)**	**J (6800L)**
Required	3,867	23,501	7,399	6,128	11,994	17,054	17,054	21,932	33,896
Available	1,085	1,673	2,145	412	8,572	16,236	6,560	11,793	5,730
Gap Estimate	2,782	21,828	5,254	5,716	3,422	818	10,494	10,139	28,166

Key Outputs

1. **Estimated oxygen need**

Number of beds and demand by bed type

It is projected that 56,886 paediatric hypoxaemic cases are observed annually with 8,440 dedicated paediatric beds. It is also estimated that there are 46,985 neonatal hypoxaemia cases, with 3,492 dedicated neonatal beds. This suggests inadequate bed capacity to manage hypoxaemia cases across assessed facilities in the country.

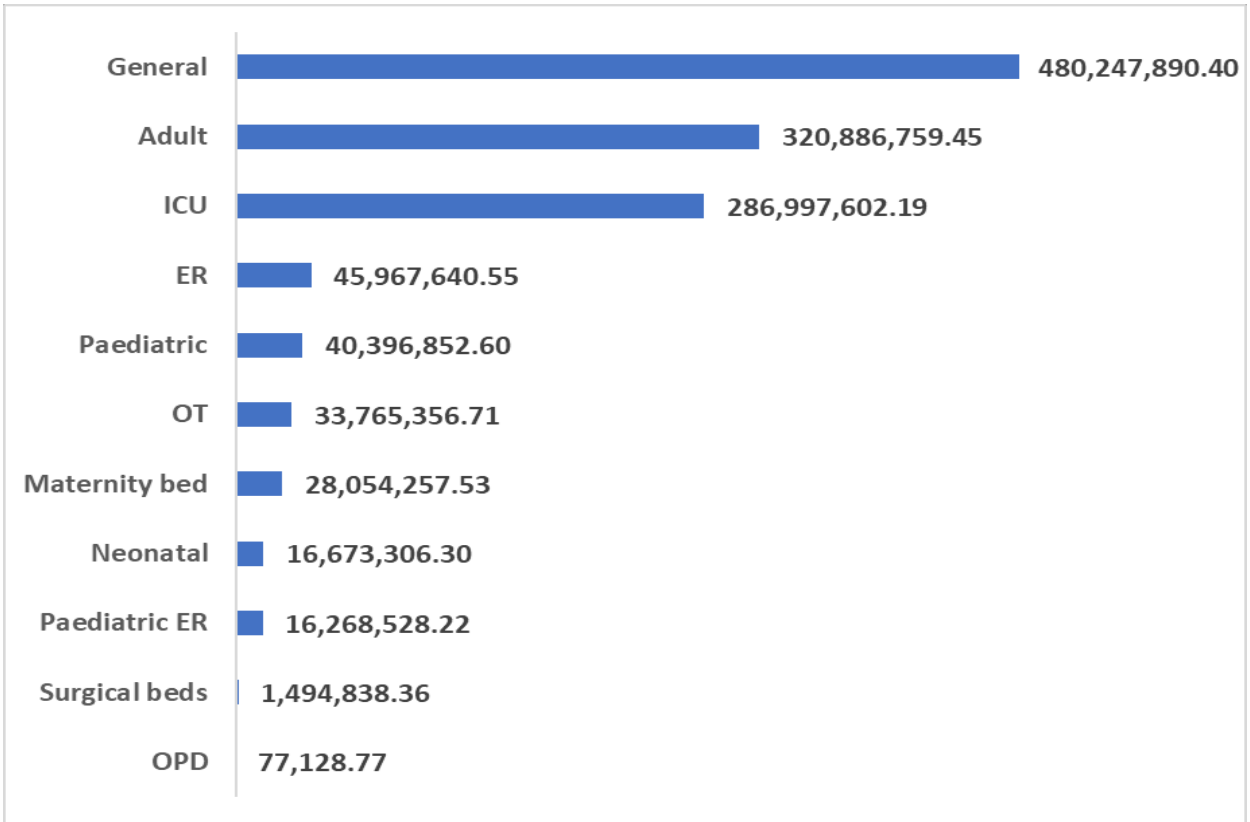


FIGURE 8: ESTIMATED OXYGEN NEED BY WARD (LITRES PER YEAR)

Available data/analysis shows that once oxygen is scaled up, the total estimated daily demand is 15 million litres of oxygen that would be needed per day, while the estimated number of hypoxaemia cases are 430,000/ year.

Cylinder Oxygen Shortage among tertiary and secondary facilities

About 42% of the facilities reported experiencing shortages in cylinder oxygen in the last 3 months preceding the survey. Common causes of this shortage as reported by facilities are presented in the figure below.

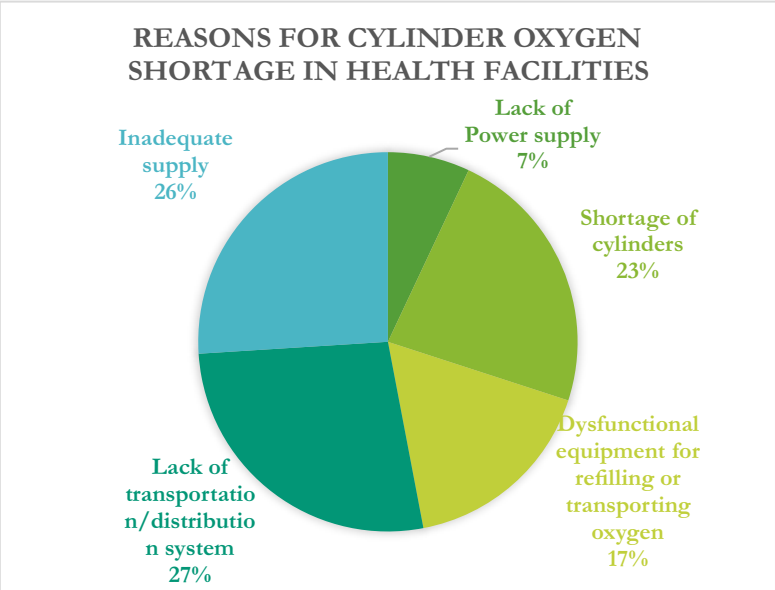


FIGURE 9: REASONS FOR CYLINDER OXYGEN SHORTAGES IN ASSESSED FACILITIES

2. **Pulse oximeter**

Approximately 24,880 Pulse oximeters were estimated to be required to support the diagnosis of hypoxaemia. At the time of the assessment, 2,758 tabletop and handheld pulse oximeters were reported to be available at all levels of healthcare. Additionally, approximately 3,638 functional fingertip pulse oximeters are also available.

TABLE 11: GAP ESTIMATES FOR PULSE OXIMETERS ACROSS LEVELS OF CARE

Type of Pulse Oximeter	Status	Primary	Secondary Health Facility	Tertiary Health Facilities	Specialized Hospital	Total
Tabletop	Required	-	2,978	875	14	3,867
	Available	-	697	388	0	1,085
	Gap	**-**	***2,281***	***487***	***14***	**2,782**
Handheld	Required	5,360	12,734	5,407	270	23,501
	Available	291	1,012	369	1	1,673
	Gap	***5,069***	***11,722***	***5,038***	***269***	**22,098**
Total	Required	5,360	15,712	6,282	284	27,638
	Available	291	1,709	757	1	2,758
	Gap	**5,069**	***14,003***	***5,525***	***283***	**24,880**

Key Oxygen Consumables

TABLE 12: OXYGEN CONSUMABLES AND ESTIMATED NEED

Patient Delivery Devices/Consumables	Estimated Annual Need	Estimated Need for Next 5 Years
Adult Nasal Cannulas	679,320	3,396,600
Paediatric Nasal Cannulas	134,440	672,200
Neonatal Nasal Cannulas	89,520	446,520

CHAPTER 4

STRATEGIC FRAMEWORK

4.0 Vision

The vision of the National Strategy for the Scale-up of Medical Oxygen is to ensure that all patients with hypoxaemia in Nigeria are properly diagnosed and treated with medical oxygen. It is the vision of the FMOH that no patient in Nigeria dies from hypoxaemia.

4.1 Strategic directions and policy priorities

The country's vision to ensure that all patients with hypoxaemia in Nigeria have access to medical oxygen and that there is no mortality due to hypoxaemia will be achieved by leveraging on past and more recent COVID-19 care investments in oxygen systems and by building on the achievements of the first ever National Oxygen strategy (2017 – 2022). It will align with the current National Strategic Health Development Plan (NSHDP - II) and other relevant government policies.

4.2 Goal

The goal is to reduce morbidity and mortality due to hypoxaemia in Nigeria by addressing the key barriers limiting access to high-quality diagnostics and medical oxygen delivery systems in health facilities. Specifically, the National Strategy will increase equitable access to oxygen for the population over the next five years by achieving the objectives outlined in 4.3 below.

4.3 Objectives of the 2023-2027 Oxygen strategy

This strategy aims to improve the availability of medical oxygen at all levels through the following five strategic objectives:

Objective 1	Coordination and partnerships: To improve governance, strengthen coordination and strategic partnerships for oxygen access scale-up in the country	***Target: By 2027*** *Multi-stakeholder coordination forums at the national level and in all states are established and strengthened to implement activities within the strategy/roadmap*
Objective 2	Oxygen supply availability: To increase availability and quality of oxygen technologies and supplies at all levels through strengthened oxygen procurement and distribution systems	***Target: By 2027*** I*ncreased availability of medical oxygen to meet 80% of estimated need*
Objective 3	Service Delivery and Use: To improve appropriate use and technical management of oxygen and oxygen diagnostic and delivery equipment at the facility level	***Target: By 2027*** *Increased use of quality diagnostics (80% of all patients receive a pulse oximetry reading)*

		All patients with hypoxaemia receive oxygen
Objective 4	Policy and Financing: To increase sustainable financing for oxygen access	***Target: By 2027*** *Inclusion of oxygen in Annual Operational Plans (AOPs) and budgets at the national and sub-national levels*
Objective 5	Data and Information Systems: To improve data management systems and monitoring for oxygen access and use	***Target: By 2027*** *All states use readily available data (HMIS, LMIS) to inform decision making)*

4.4 Implementation Strategy

Objective 1: To Improve Governance, Strengthen Coordination and Strategic Partnerships for Oxygen Access Scale-up in the Country.

Intervention 1 – Strengthen multisectoral collaboration among relevant stakeholders for national Oxygen scale up.

The FMoH and SMoHs would work with relevant MDAs, civil society organizations, professional associations etc. in disseminating the revised National oxygen strategy and guidelines at National and State levels. This also includes support to states in domesticating and adapting the strategy to meet state-specific needs.

The FMoH and the SMoHs will also adopt the best approach to sensitize MDAs, the private sector, and other relevant stakeholders to foster optimum participation as well as integrative effort towards ensuring sustained improvements of medical oxygen supply and management.

Intervention 2 – Strengthen Oxygen Coordination mechanisms at national and sub-national levels for implementation and coordination of oxygen activities.

Strengthening of the United for Oxygen (U4O) coalition and sub-national coordination platforms to effectively coordinate and map partner support will be prioritized by the FMoH and SMoHs to minimize redundancies, avoid duplication of activities/efforts, and establish a common standard. This will involve creating and maintaining a national database of all partner activities and coordinating quarterly meetings to report progress on oxygen activities and implementation of the national oxygen strategy.

Intervention 3 – Oxygen desks/units at national and sub-national levels are strengthened to provide strategic guidance for oxygen scale up and implementation of the national oxygen strategy.

Oxygen desks have been created in the FCT and 34 of the 36 states in Nigeria, with a designated desk officer, and coordinating fora exist in 16 of these states. The FMoH will work with SMoHs, the national and state coordinating fora to develop a unified Terms of Reference (ToR) and facilitate its adoption and implementation in all states and FCT. For effective coordination, the FMoH, SMoH, and partners will conduct a bi-annual meeting with the established oxygen desks in the 36 states and the FCT to assess their performance and strategize towards improving availability of medical oxygen, appropriate use and reporting in all health facilities across the states.

Intervention 4 – Integrate oxygen delivery into other existing National Guidelines and strategies.

The FMoH would work with partners, professional bodies, and organizations to identify relevant national and state guidelines and strategies that include hypoxaemia management such as the National Pneumonia Control Strategy, Essential Medicines Lists (EMLs) and Essential Equipment Lists (EELs). They will subsequently advocate for revision or adoption of specific details to align with the National oxygen strategy. The FMoH, with support from partners and agencies such as the National Emergency Management Agency (NEMA) would also develop a detailed plan for hypoxaemia management in response to potential surges in oxygen need or pandemic response and align with National plans.

Objective 2: Increase Availability and Quality of Oxygen Technologies and Supplies at all Levels through Strengthened Oxygen Procurement and Distribution Systems

Intervention 5 – Develop national oxygen and oxygen supply forecasts and quantifications to assess gaps and guide procurement plans.

The FMoH will work with partners to review and update the national oxygen assessment tool to be used for inventory assessment at both national and sub-national levels twice within the 5-year duration of the lifetime of the strategy. To ensure the availability of quality oxygen, supply must be equal to or exceed its demand. Therefore, data from the assessments would be used to develop robust quantifications and forecasting of oxygen needs at all levels to ensure oxygen availability, with additional validation steps based on the current consumption and oxygen supply state of each facility.

Intervention 6 – Develop and Disseminate Standardized Technical Specifications to Guide the Procurement, Distribution and Donation of Oxygen Technologies and Commodities.

Technical specifications are imperative to ensure standards for the purity of medical oxygen are met. The WHO-UNICEF technical specifications and WHO priority medical list provide guidance and specifications (See Annex B) for oxygen and oxygen technologies. These Global public goods documents will be leveraged and adopted for the procurement and donation of all oxygen technologies

and commodities in Nigeria. The FMoH and its partners would work with the relevant regulatory agents – the National Agency for Food and Drug Administration and Control (NAFDAC), the Standards Organisation of Nigeria (SON) etc. to identify minimum technical specifications and standards for the procurement, donation, distribution and utilization of oxygen technologies and commodities in the country. The FMoH, will work collaboratively with these agencies to ensure quality control and regulation of oxygen technologies and consumables at all levels.

Intervention 7 – Supplier Mapping and Engagement.

The FMoH will develop and maintain a database of all registered local (third party) suppliers and distributors of oxygen and oxygen technologies in-country. This is to support procurement, distribution, and easy access to oxygen equipment and devices in the country. FMoH, SMoH, and Partners will work together to gather market intelligence reports through periodic oxygen technologies and supplies market assessments, conduct periodic supplier mapping and maintain a database of major suppliers and producers of oxygen technologies in the country.

Intervention 8 – Develop Appropriate Business Models for Oxygen Equipment Deployment at all Levels.

Public-Private Partnership (PPP) structures can help strengthen management of oxygen equipment at facility level through leveraging private sector expertise, resources, skills, and capacity to strengthen oxygen supply chains. For instance, in some settings in the country, supply partnerships with private sector PSA plant operators and maintenance providers is being used to improve supply reliability and increase efficiencies. These kinds of successful partnerships will be supported in this strategy to expand the number of facilities served. To this end, the government and its partners will ensure integration of oxygen PPP structures into the National PPP platforms and plans.

The FMoH and its partners will also develop and deploy guidance resources for total cost of ownership models/context-adapted models to aid decision making for procurement of oxygen equipment. Other innovative operating approaches and business models to improve oxygen availability, affordability, and reliability will also be explored and were feasible, practicable and appropriate, will be deployed. Across the country, we will leverage a combination of existing industrial oxygen production and expanded on-site generation to rapidly increase availability of oxygen and serve wider populations.

Intervention 9 – Support Timely and Cost-Effective Procurement of equipment in line with quantifications and National Oxygen Supply Plan.

To ensure availability and supply of oxygen and oxygen equipment in health facilities across the country, it is of utmost importance to backup quantifications and national oxygen supply expansion

plans with timely and cost-effective procurements. Therefore, procurement processes of oxygen equipment will be guided by national and sub-national procurement plans, including appropriate tender and oxygen procurement documents to support delivery of timely investments.

Intervention 10 – Establish and Strengthen Procurement and Supply Chain management systems.

In order to strengthen procurement and medical oxygen supply chain management, FMoH will standardise and harmonise inventory and asset management tools which will subsequently be deployed at all levels of care. This will capture key medical oxygen equipment indicators such as availability and functionality. The FMoH, in collaboration with SMoHs and partners will also develop and maintain a medical oxygen equipment inventory for tracking oxygen devices and equipment.

Intervention 11 – Strengthen Systems and Processes for Equipment Repair, Maintenance and Replenishment.

The FMoH would work with partners in developing standardized SOPs and guidelines to inform operations, maintenance, and repair of oxygen equipment. This is necessary to preserve equipment functionality and improve availability and quality of oxygen supply at the facility-level. The federal and state governments will work with relevant stakeholders to coordinate quantification, procurement, and deployment of standard BME toolkits at the appropriate facility level to provide on-site and SMOH BMEs with the tools to undertake PPM and simple repair of equipment to sustain optimal performance and increase longevity. There will also be periodic supportive supervision to health facilities to ascertain availability and functionality of equipment, as well as BME maintenance and repair drives. A BME landscape assessment will be conducted to understand current gaps in BME/Ts workforce, deployment, distribution, and resourcing. The FMoH will consolidate all BME trainings materials into a standardized national training to support routine training for BME/Ts on equipment repair, maintenance and replenishment. Private sector BME/T facilities can be engaged to provide technical guidance where capacity is limited or requires optimisation.

Objective 3: Improve Clinical Administration and Technical Management of Oxygen at the Facility-Level

Intervention 12 – Build capacity of health care workers (including BME/Ts) on clinical use of oxygen and oxygen equipment (HR)

Findings from the National assessment conducted in 2022 showed a marked gap in Oxygen therapy administration, especially at the PHC Level. On further inquiry, most health care workers could not identify a pulse oximeter, its proper function or usage. The gap in knowledge about hypoxaemia

management will be addressed by rolling out national healthcare worker trainings on hypoxaemia case management, POX screening and the appropriate use of oxygen therapy regardless of the oxygen source or delivery interface.

The FMoH, along with her partners and agencies, will develop standardized training modules for use at the facility level. These materials will be designed to train healthcare workers across relevant cadres on the use of pulse oximetry and oxygen therapy for different age groups and medical conditions.

Hypoxaemia case management and appropriate use of oxygen therapy modules will be integrated into appropriate HCW pre-service training curricula and in-service Continuing Medical Education (CME) training programs.

Intervention 13 – Oxygen is integrated into supportive supervision, mentoring and appropriate quality improvement platforms at national and sub-national levels to increase adherence to treatment guidelines.

To promote adherence to guidelines at the facility level, integrated supportive supervision (ISS) on hypoxaemia management will be incorporated into routine ISS and mentoring programs across all levels of care. The FMoH, SMoHs and partners will work closely with key stakeholders to review and disseminate appropriate SOPs for oxygen use at service delivery points in health facilities. In addition, existing supportive supervision and mentoring tools will be reviewed to include key hypoxaemia indicators. Trainings of HCWs at all levels of care for use of these tools will be complemented by the deployment of innovative low-cost, high-frequency capacity building mechanisms such as peer mentoring and peer-led learning approaches at the facility-level. To increase adherence to treatment guidelines, the FMoH, SMoHs, partners and health facilities would work together to inaugurate facility quality improvement teams (QITs) and, where they exits strengthen them and include key oxygen indictors into these QIT platforms including in the deployment of tools and the appropriate processes.

Intervention 14 – Strengthen hospital referral systems across all levels of care.

Generally, referral systems within the Nigeria healthcare system are sub-optimal with considerable variation across states. This often results in disruptions in the continuum of care for patients and, consequently, to adverse health outcomes. To improve clinical administration and management of oxygen at the facility level, effective referral systems are also needed. Therefore, a medical oxygen referrals systems gap assessments will be undertaken to clearly define and understand the drop-offs in the referral's pathways - particularly at the PHC level. Information from these assessments will be used to define the appropriate remedial actions and activities to be undertaken. For instance, patient

triage, hypoxaemia screening and referral initiation will be included in revised national hypoxaemia training modules and oxygen supply expansion plans should make provisions for ambulatory oxygen services.

Objective 4: Increase Sustainable Financing for Oxygen Access

Intervention 15 – Develop a Resource Mobilization Strategy to Guide Large-Scale Oxygen Investments.

A robust plan for financing oxygen activities is critical to ensure that the activities detailed in this roadmap can be successfully implemented. To build long-term commitments for oxygen access scale-up, the FMoH, SMoHs and partners will explore a variety of financing options and employ a combination of solutions. Within the national and state health budgets, there should be a dedicated allocation for oxygen-related activities under all relevant health MDAs. External donor funding sources should also be identified and confirmed for relevant activities costed under the oxygen roadmap. The FMoH will develop a resource mobilization strategy and investment case for advocacy to improve resource mobilization for and sustained investments in oxygen in the country.

Intervention 16 – Increased Prioritization and Financing of Oxygen.

Beyond securing initial funds for activities, sustainable funding mechanisms including results-based financing (RBF), cost recovery mechanisms such as drug revolving funds (DRF) and PPP, government will garner strong political will to ensure the prioritization of efficient oxygen delivery systems in health facilities. State governments and health facilities should explore sustainable and innovative financing mechanisms that spread costs over time and populations - such as inclusion in facility DRF schemes, annual operational plans, and other functional state-funded maternal, newborn and child health (MNCH) programmes.

Oxygen desks in the states will be provided with the tools, resources and capacity to develop oxygen investments cases and supported to ensure the inclusion of oxygen program interventions within states' health annual operational plans (AOPs) and to develop robust capital and recurring expenditure budgets – increasing predictable public funding for oxygen, oxygen-related equipment, and maintenance services.

The FMoH would also explore the feasibility of including oxygen therapy as a covered service under the National Health Insurance Scheme (NHIS), the Basic Health Care Provision Fund and in state health insurance schemes that are currently being rolled out in most states in the country under the National Health Insurance Act as key interventions towards universal health coverage. These represent

a substantial opportunity to dramatically increase the resources available for sustainable oxygen systems.

Federal and state governments will also assess opportunities to establish or strengthen relationships with the private sector. For example, PPP may be explored to identify cost effective and sustainable models for expanding oxygen delivery systems (e.g., for oxygen plant ownership, operations, and maintenance).

Objective 5: Improve Data, Information Systems and Monitoring for Oxygen Access

Intervention 17 – Update and Refine National indicators and deploy data collection tools and systems for oxygen.

To improve hypoxaemia management in health facilities, relevant hypoxaemia and oxygen availability, access, and usage data must be collected and reviewed systematically. This includes both data about hypoxaemia diagnosis and management in patients, and data about and consumption of oxygen, availability and functionality of oxygen equipment, and oxygen consumables.

For hypoxaemia diagnosis and management, FMoH will avoid creating parallel data collection systems by working with the relevant units and departments in the ministry like the DPRS to review and strengthening current templates for patient records with relevant fields for oxygen therapy (i.e., blood oxygen saturation levels, administration of oxygen, etc.). To maximize existing systems for reporting, national stakeholders will be mobilized to select and adopt oxygen therapy and hypoxaemia management indicators, review the 2019 NHMIS tools to include adopted indicators, and integrate these into the District Health Information System (DHIS 2) to enable data reporting and availability. Additionally, this will involve printing and distribution of revised NMHIS tools for use in all health facilities as well as training of healthcare workers on the new tool. Through this system, relevant data would be collected at health facilities using appropriate NHMIS tools and uploaded into the DHIS 2. It is anticipated that a temporary oxygen staging server will be created to host oxygen-related indicators pending full integration into the NHMIS to facilitate data reporting and evidence-based decision-making at all levels.

For measuring and monitoring oxygen supply (i.e., oxygen availability, functionality of equipment, etc.), the appropriate indicators will be developed and validated, and interventions will include expanding and improving biomedical equipment databases and inventory/assets management systems. Bulk sources should be procured with appropriate monitoring and tracking systems e.g, telemetry devices for LOX storage tanks with outputs reviewed regularly to manage oxygen supply chain

performance. Where feasible, engagements with manufacturers and suppliers will be done to embed remote monitoring technologies into the most critical pieces of equipment.

Intervention 18 - Support use of data for evidence-based decision making.

With the adoption, printing, distribution, and use of the revised NHMIS tools at health facilities and DHIS 2, there would be a significant improvement in data availability at all levels. Routine data quality assessment (DQA) visits to health facilities will be conducted to assess the timeliness, availability, validity, and consistency of oxygen data at service delivery levels. This process will be conducted using nationally adopted DQA tool for oxygen. In addition, the country will leverage technical support to create automated dashboards to monitor usage and functionality across facilities and states and triangulate this with service delivery data. Through the appropriate use of data, the FMoH and SMoHs will be able to develop data driven preventive maintenance plans and to design systems that rapidly report equipment breakdowns. The FMoH would also work with partners in developing mechanisms to support review of data, action plans and decision making for oxygen programming at national and subnational level.

Intervention 19 – Research, learning and evidence generation.

The FMoH and partners will collaborate with the academia to create a research repository to enhance dissemination of evidence and gather information on implementation. Partners will collaborate with academic and government institutions to maintain a list of relevant on-going and completed studies in Nigeria. A call for abstracts and presentation for operational research and study findings will occur on a regular basis and the country will explore opportunities for global research partnerships and other regional and global platforms for lessons sharing.

CHAPTER 5
IMPLEMENTATION PLAN

To achieve the goal and objectives of the National Oxygen Strategy, the work plan below articulates the relevant strategies, broad activities, implementation timeline and responsible entities.

5.1 National Oxygen Strategy (2023 – 2027) Workplan

TABLE 13: FIVE-YEAR STRATEGY FRAMEWORK

Strategic Objectives and Key Activities	Responsible Person(s)	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
Objective 1: To Improve Governance, Strengthen Coordination and Strategic Partnerships for Oxygen Access and Scale-up in the Country						
Intervention 1 – Strengthen multisectoral collaboration among relevant stakeholders for national Oxygen scale up						
Activity 1.1: Disseminate the revised national oxygen strategy and roadmap at national and sub-national levels through the relevant and appropriate platforms	FMoH, SMoH, Partners					
Activity 1.2 Support states to adopt/adapt the national oxygen strategy to suit local contexts at the state level	FMoH, SMoH, Partners					
Activity 1.3 Develop advocacy materials and resources to support advocacy efforts towards oxygen scale-up	FMoH and Partners					
Activity 1.4 Conduct biannual advocacy visits to senior management of relevant MDAs e.g., NHIA, NPHCDA, SON, NAFDAC, policy makers, the executive arm of government and other relevant stakeholders to increase engagement and involvement in the oxygen scale-up plan	FMoH and Partners					
Activity 1.5 Disseminate advocacy materials on national roadmap and activities to relevant stakeholders including the private sector.	FMoH and Partners					
Intervention 2 – Strengthen Oxygen Coordination mechanisms at national and sub-national levels for implementation and coordination of oxygen activities						

Activity 2.1 Develop, update, and maintain a comprehensive oxygen partner mapping as a national database	FMoH					
Activity 2.2 Provide and maintain strategic linkages with other platforms at the global, national, and sub-national levels e.g., EBC, other SRMNCH platforms through attending meetings and provision of strategic information/data on oxygen	FMoH, SMoH					
Activity 2.3 Establish and strengthen functional oxygen coordination forums at sub-national level	FMoH and Partners					
Activity 2.4 Organize quarterly meetings to track and report on progress of oxygen programme activities.	FMoH and Partners					
Intervention 3 –Oxygen desks/units at national and sub-national level are strengthened to provide strategic guidance for oxygen scale up and implementation of the national oxygen strategy						
Activity 3.1 Develop, adopt, and disseminate a unified TOR for oxygen desks at the national and sub-national levels that defines key roles and responsibilities	FMoH and Partners					
Activity 3.2 Establish functional oxygen desks in all states and the FCT and maintain database of key staff for oxygen units	FMoH, SMoH and Partners					
Activity 3.3 Roll out capacity building for oxygen desks/units to strengthen their capacity for oxygen programme implementation and decision making	FMoH, SMoH and Partners					
Activity 3.4 Conduct advocacy for inclusion of funding for oxygen desks in national and state budgets	FMoH, SMoH					
Activity 3.5 Conduct bi-annual (every 6 months) oxygen desk review meeting with 36 states + FCT	FMoH, SMoH and Partners					
Intervention 4 – Integrate oxygen systems into other existing national policies, guidelines and strategies						
Activity 4.1 Undertake advocacy and provide technical support to appropriate MDAs, professional bodies and programmes (such as Minimum Service Package (MSP), EML, Essential Equipment List etc) to include oxygen in appropriate policies, guidelines and strategies	FMoH and SMoH					
Activity 4.2 Integrate oxygen into the preparedness plans for future or potential surges in oxygen need	FMoH, NEMA, SMoH and partners					
Objective 2: Increase Availability and Quality of Oxygen Technologies and Supplies at all Levels through Strengthened Oxygen Procurement and Distribution Systems						
Intervention 5 – Develop national oxygen forecasts and quantifications to assess gaps and guide procurement plans						
Activity 5.1 Undertake biennial (every 2 years) review and update of national oxygen assessments and quantification tools for inclusion of new/relevant oxygen supply indicators	FMoH and partners					
Activity 5.2 Build capacity of both national and sub-national oxygen units and desks on the use of national oxygen quantification and forecasting tools	FMoH and partners					

Activity 5.3 Update oxygen forecasts based on national oxygen assessments to reflect current oxygen landscape and disseminate validated national oxygen forecasts	FMoH, SMoH and Partners						
Activity 5.4 Review and integrate oxygen supply plans into national supply chain reviews and plans	FMoH and partners						
Intervention 6 – Develop and Disseminate Standardized Technical Specifications to Guide the Procurement, Distribution and Donation of Oxygen Technologies and Commodities							
Activity 6.1 Develop and disseminate technical specifications to guide procurements of oxygen commodities at all levels - national, state and facilities	FMoH and partners						
Activity 6.2 Develop and disseminate guidelines for oxygen and oxygen equipment donations	FMoH and partners						
Activity 6.3 Periodically review and update technical specifications for oxygen products procurements and donations guidelines and disseminate accordingly	FMoH						
Activity 6.4 Develop technical guidelines to support quality maintenance and repairs of oxygen technologies and equipment	FMoH and partners						
Activity 6.5 Engage and support regulatory agencies like NAFDAC and SON to strengthen systems and capacity for ongoing monitoring of the quality of oxygen technologies and supplies							
Intervention 7 – Supplier Mapping and Engagement							
Activity 7.1 Undertake annual oxygen technologies and supply markets assessments and develop market intelligence reports to be disseminated at all levels	FMoH and Partners						
Activity 7.2 Conduct supplier mapping exercise and maintain database of major suppliers and producers of oxygen and oxygen technologies	FMoH, SMoH and Partners						
Activity 7.3 Convene national oxygen supplier forums to create linkages between oxygen suppliers and decision makers at national and sub-national levels	FMoH						
Intervention 8 – Develop Appropriate Business Models for Oxygen Equipment Deployment at all Levels							
Activity 8.1 Investigate and document PPP structures to identify opportunities and appropriate models for PPP engagement	FMoH and Partners						
Activity 8.2 Integrate oxygen PPP structures into the National PPP platforms and plans as appropriate	FMoH						
Activity 8.3 Develop guidance resources for Total Cost of Ownership Models for key oxygen equipment	FMoH and Partners						
Activity 8.4 Support the deployment of appropriate context-adapted oxygen technologies operating models	FMoH and Partners						
Intervention 9 – Support Timely and Cost-Effective Procurement of equipment in line with quantifications and National Oxygen Supply Plan							

Activity 9.1 Develop data-based annual procurement plans at national and sub-national levels	FMoH, SMoHs					
Activity 9.2 Develop appropriate tender and oxygen procurement documents in line with standardized technical specifications and guidelines	FMoH, SMoHs					
Activity 9.3 Procure and distribute appropriate commodities in line with national supply and procurement plans	FMoH, SMoHs and Partners					
Intervention 10 – Establish and Strengthen Procurement and Supply Chain management systems						
Activity 10.1 Harmonize and standardize national oxygen inventory tools that can be deployed at all levels, including indicator definition for oxygen equipment, spares and consumables through national stakeholder meetings/workshops	FMoH and Partners					
Activity 10.2 Deploy inventory management tools at all levels that captures key oxygen equipment indicators: availability, functionality, operational capacity, quality etc.	FMoH and Partners					
Activity 10.3 Build capacity of appropriate staff (Oxygen desks, state BMEs, Facility managers etc.) at the national and sub-national levels on the use of the inventory tools and system	FMoH, SMoHs and Partners					
Activity 10.4 Develop and maintain a database of oxygen equipment inventory for tracking of oxygen devices and equipment	FMoH, SMoHs and Partners					
Activity 10.5 Develop a national dashboard to track oxygen production and consumption at scale (PSA plants, LOX etc) in the country	FMoH, SMoHs and Partners					
Activity 10.6 Deploy appropriate systems for tracking and reporting of oxygen consumables and spare parts and explore integration into existing LMIS/EMIS	FMoH, SMoHs and Partners					
Activity 10.7 Generate quarterly oxygen inventory and supply reports through deployment of an integrated, interactive, and user-friendly dashboard and disseminate at the appropriate levels	FMoH, SMoHs and Partners					
Activity 10.8: Develop a unified server/database for oxygen supply and production	FMoH and Partners					
Activity 10.9 Undertake (biennial) review of inventory tools and systems and update/disseminate as appropriate	FMoH and Partners					
Intervention 11 – Strengthen Systems and Processes for Equipment Repair, Maintenance and Replenishment						
Activity 11.1 Develop SOPs and guidelines for operations, planned preventive maintenance (PPM) and repair of oxygen equipment	FMoH and Partners					
Activity 11.2 Disseminate SOPs and guidelines at the sub-national and health facility levels	FMoH, SMoH and Partners					
Activity 11.3 Develop standardized list of BME-focused equipment toolkit and training curriculums to support equipment repair and maintenance	FMoH and BMEs Association and Private sector					

Activity 11.4 Procure and deploy BME toolkits in states and facilities to ensure availability of basic repair and maintenance equipment at the appropriate level and in sufficient quantities	SMoHs and Facilities					
Activity 11.5 Roll out routine supervision to health facilities to ascertain availability and functionality of oxygen equipment	FMoH, SMoH and Partners					
Activity 11.6 Conduct BME-driven repair drives to undertake PPM and simple repairs of non-functional equipment	FMoH, SMoH and Partners					
Activity 11.7 Undertake a comprehensive BME Landscape assessment to understand current gaps and develop recommendations for improvement	FMoH and Partners and BME Association					
Activity 11.8 Conduct advocacy to improve the number of trained BMEs, deployment, conditions of service etc. at the appropriate levels	FMoH, SMoH and Partners					
Objective 3: Improve Clinical Administration and Technical Management of Oxygen at the Facility-Level						
Intervention 12 – Build capacity of HCWs on clinical use of oxygen and oxygen equipment (HR) (including Biomedical Engineers or Technicians)						
Activity 12.1 Review and update national clinical guidelines on oxygen use at the facility level	FMoH and Partners					
Activity 12.2 Disseminate national clinical guidelines on oxygen use across all levels of care	FMoH, SMoH and Partner					
Activity 12.3 Incorporate modules on hypoxaemia case management and oxygen use in relevant HCW pre-service and in-service training curricula	FMoH, SMoH, FME and Partners					
Activity 12.4 Roll out a national hypoxaemia management and oxygen use TOT to build a cohort of national oxygen master trainers	FMoH, SMoH and Partners					
Activity 12.5 Conduct new and refresher trainings for HCWs on hypoxaemia case management, medical oxygen use and maintenance of oxygen equipment	FMoH, SMoH and Partners					
Activity 12.6 Develop and maintain harmonized national database of trained HCWs (including BMEs)	FMoH and Partners					
Activity 12.7 Conduct new and refresher trainings for BMEs on planned preventive maintenance and repairs for oxygen equipment and delivery systems	FMoH and Partners					
Intervention 13 – Oxygen is integrated into supportive supervision, mentoring and appropriate quality of care improvement platforms at national and sub-national levels to increase adherence to treatment guidelines						
Activity 13.1 Review existing supportive supervision and mentoring tools to include key hypoxaemia management indicators	FMoH, SMoH and Partners					
Activity 13.2 Build capacity at all levels for use of revised supportive supervision and mentoring tools	FMoH, SMoH and Partners					

Activity 13.3 Roll out integrated supportive supervision and mentoring - including innovative mechanisms like peer mentoring and peer-led learning approaches	FMoH, SMoH					
Activity 13.4 Inaugurate and/or strengthen existing facility quality improvement teams with clear TORs and reporting indicators for oxygen use and hypoxaemia case management	FMoH, SMoH, Partners and HFs					
Activity 13.5 Build capacity of the QI teams and roll out QI tools	FMoH, SMoH, Partners and HFs					
Intervention 14 – Strengthen hospital referral systems						
Activity 14.1 Undertake gap assessment for referral systems for hypoxaemia to understand gaps and drop-offs in the pathway across all levels	FMoH and Partners, NPHCDA					
Activity 14.2 Build capacity of HCWs on appropriate hypoxaemia referrals: patient screening, triage, referrals initiation, feedback, etc.	FMoH and Partners					
Activity 14.3 Conduct advocacy to the FMOH's emergency medical services (EMT) to ensure medical oxygen is included in ambulance services	FMoH, FRSC, Partners					
Objective 4: Increase Sustainable Financing for Oxygen Access						
Intervention 15 – Develop Resource Mobilization Strategy to Guide Large-Scale Oxygen Investments						
Activity 15.1 Conduct annual oxygen systems resource mapping exercises to provide up-to-date and relevant information on oxygen investments	FMoH and Partners					
Activity 15.2 Develop resource mobilization strategy, investment case and appropriate advocacy documents for increased oxygen investments	FMoH and Partners					
Intervention 16 – Increased Prioritization and Financing of Oxygen						
Activity 16.1 Conduct advocacy to relevant MDAs, programmes and public financing mechanism for inclusion of oxygen in appropriate health benefits packages like States Health Insurance Agencies (SHIA), National Health Insurance Agency (NHIA), BHCPF, SRMNCH, GFF, GF RSSH etc	FMoH and Partners					
Activity 16.2 Incorporate oxygen programme into annual operational plan/budgets at the national and sub-national levels to ensure implementation and for procurement of oxygen technologies and supplies	FMoH, SMoHs and Partners					
Activity 16.3 Conduct quarterly advocacy to relevant MDAs to ensure timely release of budgetary funds for oxygen systems and programmes	FMoH, SMoHs and Partners					
Activity 16.4 Advocate and support integration of oxygen into existing financing mechanisms - DRF, RBF, PPP etc. at the facility and state level	FMoH, SMoHs and Partners and HFs					

Activity 16.5 Develop and support structures for pooling oxygen demand to create economies of scale, and improve availability, affordability, and reliability of oxygen supply	FMoH and Partners					
Activity 16.6 Track and monitor budgetary allocations and expenditure for oxygen at national and sub-national levels	*FMoH and SMoHs*					
Objective 5: Improve Data, Information Systems and Monitoring for Oxygen Ecosystem						
Intervention 17 – Update and Refine National indicators and deploy data collection tools and systems for oxygen						
Activity 17.1 Identify relevant stakeholders, organize meeting to map and review existing assessment tools and platforms for collecting oxygen information.	*FMoH and Partners*					
Activity 17.2 Define specific national indicators on oxygen to be collected and included in the appropriate data collection tools and platforms: hypoxaemia diagnosis and prevalence; hypoxaemia management, oxygen availability, oxygen quality and administration	FMoH and Partners					
Activity 17.3 Hold planning and sensitization meetings with key stakeholders – Department of Planning Research and Statistics (DPRS), LMCU to provide evidence and strategic guidance for the inclusion of oxygen-related indicators in NHMIS and LMIS systems	FMoH and Partners					
Activity 17.4 Roll out new and refresher trainings to build the capacity of national, state, LGA and facility-level staff on the oxygen data systems and tools.	*FMoH, SMoHs, Partners, HFs, NPHCDA, SPHCDBs, HMBs*					
Activity 17.5 Deploy revised data collection tools at all levels	*FMoH, SMoHs, Partners, HFs, NPHCDA, SPHCDBs, HMBs*					
Intervention 18- Support use of data for evidence-based decision making						
Activity 18.1 Conduct facility-level (DQA) visits to verify and improve timeliness, accuracy and completeness of oxygen service data	*FMoH, SMoHs, Partners, HFs, NPHCDA, SPHCDBs, HMBs*					
Activity 18.2 Develop an interim data repository for service delivery pending update of indicators for oxygen data on DHIS2 as well as national automated oxygen reporting dashboards and reports	*FMoH, SMoHs, Partners, HFs, NPHCDA, SPHCDBs, HMBs*					
Activity 18.3 Conduct periodic meetings (monthly/quarterly/annually) to review oxygen data through appropriate platforms at all levels	*FMoH, SMoHs, Partners, HFs,*					

	NPHCDA, SPHCDBs, HMBs					
Activity 18.4 Strengthen facility-level QIT meetings to review information, ensure continuous monitoring for data quality and use in decision making at health facilities	*FMoH, SMoHs, Partners, HFs, NPHCDA, SPHCDBs, HMBs*					
Activity 18.5-Conduct mid and end-term reviews of the implementation of the National oxygen strategy	ALL					
Intervention 19 – Research, learning and evidence generation						
Activity 19.1 Create a national online oxygen data repository to access or share research findings	FMoH and Partners and Academics					
Activity 19.2 Establish a community of practice for hypoxaemia and oxygen that allows access to wide range of shared oxygen information and resources	FMoH and Partners and HFs and Associations					
Activity 19.3 Work with relevant stakeholders to identify research priorities (e.g., Cost effectiveness analysis, feasibility and scale of deployment of Oxygen at PHC level) in oxygen ecosystem	FMoH, Partners, Academics					
Activity 19.4 Identify and leverage national and global funding opportunities for research and research dissemination via appropriate platforms	FMoH and Partner					

5.2 Costed Implementation Plan

To implement the interventions for the 5-year implementation framework, a significant amount of funding commitment would be required. The Table below summarizes the costs to implement each objective of the strategy. Additional costing details required to fully implement the strategy can be found in the Annexes.

TABLE 14: COSTED IMPLEMENTATION PLAN

Objectives and Strategy	2023	2024	2025	2026	2027	(2023 to 2027 total)	(% Total Cost)
Objective 1: To Improve Governance, Strengthen Coordination and Strategic Partnerships for Oxygen Access Scale-up in the Country	145,028,375.00	70,661,156.25	47,779,906.25	47,779,906.25	47,779,906.25	359,029,250.00	**13.60**
Objective 2: Increase Availability and Quality of Oxygen Technologies and Supplies at all Levels through Strengthened Oxygen Procurement and Distribution Systems	195,627,450.00	72,208,575.00	38,397,450.00	115,403,575.00	38,187,450.00	459,824,500.00	**17.41**
Objective 3: Improve Clinical Administration and Technical Management of Oxygen at the Facility-Level	748,182,100.00	533,081,150.00	180,648,750.00	173,002,500.00	173,002,500.00	1,807,917,000.00	**68.46**
Objective 4: Increase Sustainable Financing for Oxygen Access	162,500.00	1,893,750.00	162,500.00	1,893,750.00	162,500.00	4,275,000.00	**0.16**
Objective 5: Improve Data, Information Systems and Monitoring for Oxygen Access	845,000.00	0.00	4,489,500.00	0.00	4,489,500.00	9,824,000.00	**0.37**
Grand total in Local Currency	**1,089,845,425.00**	**677,844,631.25**	**271,478,106.25**	**338,079,731.25**	**263,621,856.25**	**2,640,869,750.00**	**100.00**
Grand total in USD (CBN Rate: 443.63)- Nov 2022	**2,456,654.02**	**1,527,950.39**	**611,947.13**	**762,075.90**	**594,238.12**	**5,952,865.56**	

5.3 Resource Mobilization for Implementation

The FMoH would develop a resource mobilization strategy to support full implementation of interventions and activities outlined in the implementation plan. Oxygen activities and programmes have been funded by the government, donor agencies, partners and private sector through various forms of support such as capacity building, procurement and installation of equipment and consumables etc. Innovative financing mechanisms like PPP-models, integration with existing financial mechanisms such as the BHCPF, inclusion into the social health insurance scheme, advocacy for increased allocation and prioritization of oxygen financing into national and state budgetary allocation amongst others should be explored, to ensure that the country achieves its goal of a strengthened and equitable oxygen eco-systems that is able to provide high-quality oxygen services to all hypoxaemic patients.

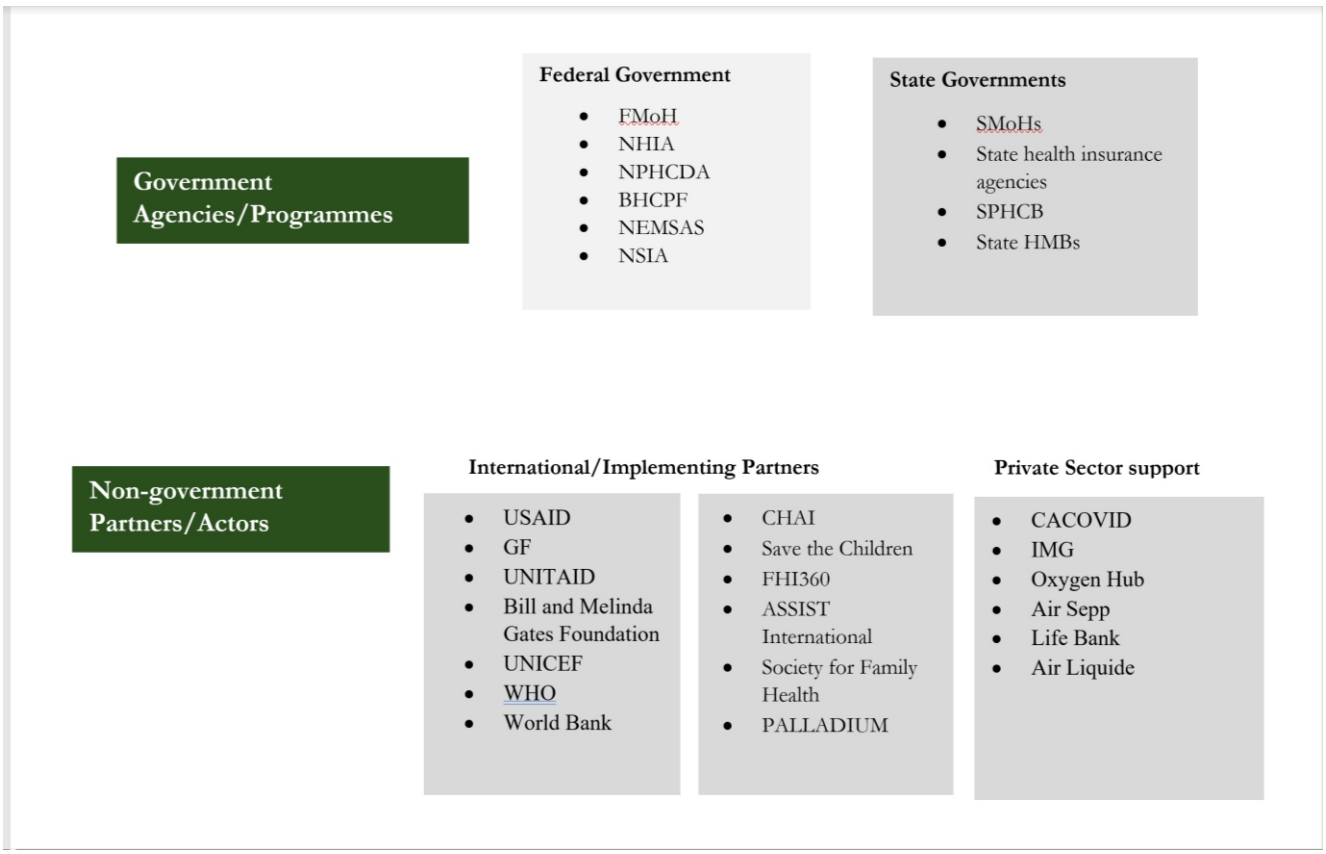


FIGURE 10: KEY STAKEHOLDERS FOR FINANCING MEDICAL OXYGEN SCALE-UP

CHAPTER 6

Monitoring, Evaluation, Accountability and Learning

Monitoring and Evaluation

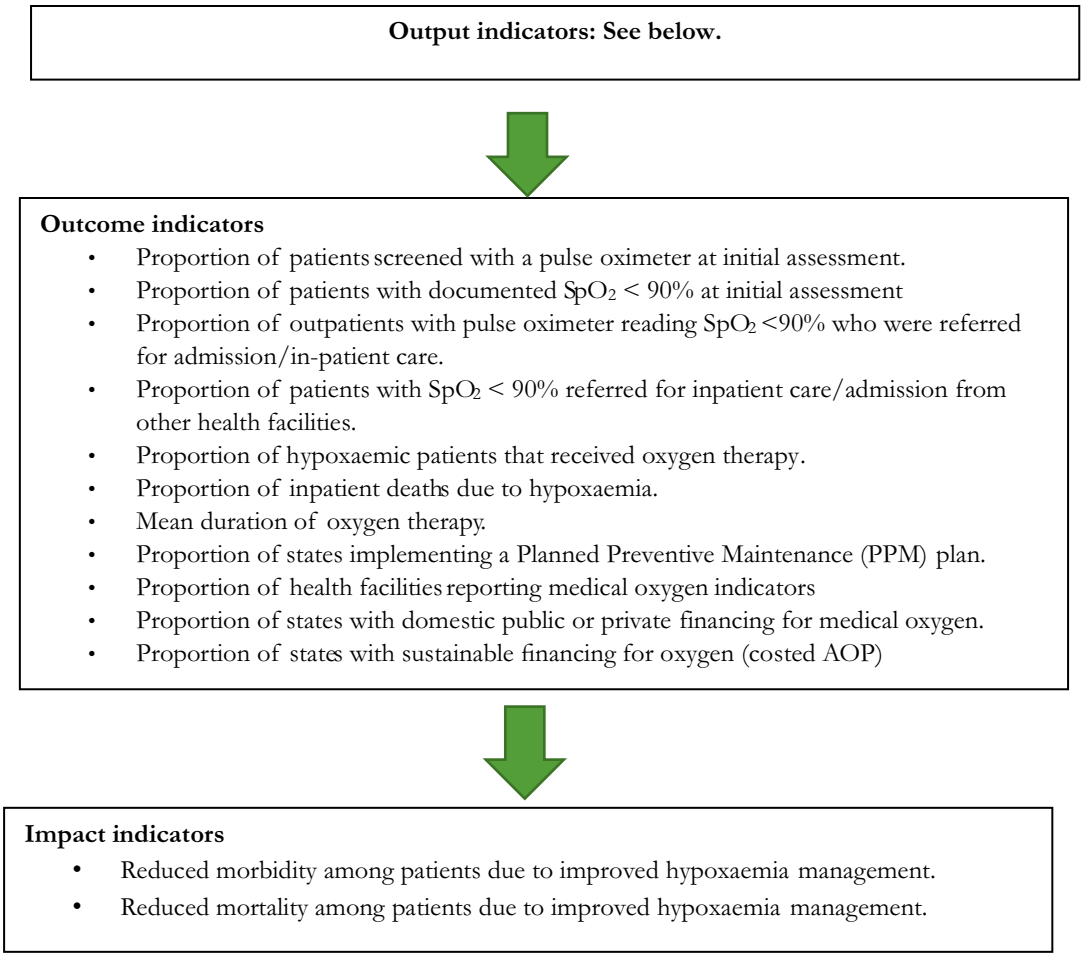
To effectively track and improve the implementation and outcomes of this strategy, it is essential to monitor and evaluate the activities and inputs set forth in this scale-up plan. The performance monitoring framework lays out the set of indicators to track key outputs and outcomes and conduct periodic reviews. In addition to the establishment of systematic data collection and review such as inventory and hypoxaemia management record-keeping and reporting, key data and resources feed into the following periodic monitoring and evaluation activities:

I. Monthly oxygen data review meetings at the state and LGA levels, coordinated by the state oxygen desk.
II. Quarterly review meetings at the state level, to be coordinated by the state oxygen desk.
III. Biannual partner updates and data review meeting on oxygen related activities from partners and state oxygen desks, coordinated by the oxygen desk within U4O.
IV. Quarterly data quality assessment visits by state and national teams
V. Integrated supportive supervision and mentoring visits to health facilities.
VI. Annual review meetings and presentation of annual reports from FMoH, SMoH, and partners

6.1 Performance Monitoring Framework

The framework helps to systematically track implementation, and measure outputs, and outcomes of the strategy. It helps determine when the plan is on track and when changes may be needed. The operational definition of indicators, sources, frequency of measure, level of measurement and the responsible entities are listed in Annex D.

The key indicators presented in Annex D below will be periodically reviewed by coordinating mechanisms at national and state levels to assess progress against set targets.



Accountability

The five-year implementation plan, targets, and indicators will form the basis of an accountability framework for the strategy. The accountability approach for the strategy shall involve:

- Monitoring – the FMoH/SMoHs shall coordinate partners, track and monitor progress of all planned activities and their results.
- Review – the FMoH/SMoHs shall work with partners in assessing whether commitments have been seen through with outputs.
- Remedial action: this will document planned corrective actions to government and non-government stakeholders on how to address gaps identified during reviews.

6.2 Output Indicators

TABLE 15: OUTPUT INDICATORS

Policy	Availability	Practices	Financing	Data Systems
• Number of strategy dissemination meetings conducted. • Documents for procurement, distribution and donation of oxygen technologies & commodities developed. . • Total cost of ownership models developed. • Number of National SOPs for PPM developed and disseminated. • Clinical guidelines for management of hypoxaemia updated. • Number of states where updated clinical guidelines for management of hypoxaemia has been disseminated.	• Database of suppliers of oxygen related technologies and services developed. • Inventory management system for oxygen equipment developed.	• Number of quarterly U4O meetings held. • Number of states with oxygen desk. • Number of states with functional oxygen co-ordinating forum. • Number of states with oxygen desks that participate in national bi-annual review meetings. • Number of states with planned preventive maintenance (PPM) plan that includes oxygen equipment. • Number of states that implemented the planned preventive maintenance (PPM) plan. • Number of states that carried out repair drives. • Number of HCW/BMETs trained on oxygen equipment use and maintenance. • Number of HCWs trained on medical oxygen use	• Number of medical oxygen quantification and forecast conducted. • Number of state procurements made in line with procurement plan. • Domestic resource mobilization strategy for medical oxygen investments developed. • Number of states with costed annual operational plan that includes medical oxygen.	• Integrated Supportive Supervision (ISS) tool reviewed and updated with medical oxygen indicators. • Number of supportive supervisions conducted. • Medical oxygen data repository (MODR) developed. • Number of health facilities that report medical oxygen data through the medical oxygen data repository (MODR) or DHIS 2. • Number of medical record officers, oxygen desk officers and LG M&E officers trained on the use of medical oxygen data tools. • Number of medical record officers, oxygen desk officers and LG M&E officers trained on the use of DHIS for medical oxygen or medical oxygen data repository (MODR). • Number of states that conducted quarterly DQA. • Number of periodic (monthly, quarterly & annual) meetings conducted to review medical oxygen data. • Midterm review of implementation of national strategy conducted. • End line review of implementation of national medical oxygen strategy conducted. • Online national oxygen data repository for research findings developed. • Community of practice for medical oxygen use established. • Number of medical oxygen-related learning sessions held.

		and hypoxaemia management.		• Number of medical oxygen-related research funded by FMoH and partners. • Desk review of selected national guidelines conducted to assess oxygen inclusion.

6.3 Strategy Risk and Mitigation approaches

FMoH and NPHCDA leadership, State Ministries, MDAs, and multisector stakeholders will support the implementation of this strategy. The table below summarizes key risks that could impede successful implementation, as well as proposed mitigation approaches.

TABLE 16: RISKS AND MITIGATION APPROACHES

Risk	Mitigation
Poor sub-national coordination, collaboration, and governance	• Empower Federal and State oxygen desks to coordinate medical oxygen activities through the national and state-level oxygen coordinating forums. • Ensure broad dissemination of the revised strategy at sub-national levels and engagement with the SMOHs. • Build capacity of state coordinating fora to for effective implementation of the strategy at sub-national levels • The National oxygen desk would support state in guiding coordination meetings and would develop accountability structures to ensure stakeholders are fully engaged and carried along on new initiatives and plans
Capacity of Oxygen desks to provide guidance at national and sub-national levels	• The FMoH along with U4O partners would build the capacity of state desk officers and provide relevant resources and tools for strategic guidance into oxygen systems and programming. • Where there is a gap in capacity or technical expertise, the FMoH shall engage with partners through relevant platforms like the U40 to support activities
Inadequate/poor funding	• The FMoH and partners shall develop a resource mobilisation strategy to support the implementation of the strategy. • Advocacy to state government and relevant stakeholders for integration and inclusion of oxygen into existing health benefit backages and financing models. • The FMoH shall develop an advocacy/investment case brief for advocacy. • SMoHs to include oxygen in their annual operating plan and budgeting as well as donor agencies, partners, and private bodies
Lack of technical documents to guide regulatory activities	• Wide dissemination of and sensitization on the recommended technical specifications for regulating oxygen technology procurement, distribution, and donation in the country.
Limited participation of the Private Sector	• Advocacy and sensitization of private sectors players of the strategy at national and sub-national levels • Establishment of PPP- structures at National and sun-national levels for the implementation of the strategy
Weak Data Systems to enable performance tracking	• Advocacy to state government agencies for adoption of NHMIS • Train relevant healthcare workers and BME/Ts to collect quality data

CHAPTER 7
GOVERNANCE, COORDINATION AND PARTNERSHIP

7.1 Governance and Coordination

Coordination of partner efforts to scale-up access to medical oxygen will be critical for achieving successful and efficient implementation of the National Strategy. The FMoH will explore existing mechanisms that may be leveraged to drive progress on implementation. Oversight and accountability for the implementation of the National strategy would be provided by the national and state oxygen desks and the United for Oxygen coalition. The coordinating mechanism will include sub-committees to drive progress in specific areas such as supply and distribution, clinical governance, equipment maintenance, regulation, policy and financing needed to anchor multi-stakeholder engagement on partner strengths and expertise. The FMoH would work with states to establish and standardise approach for coordinating forum ***(See Annex C for Terms of Reference)*** and sub-committee to align with the objectives of the National Strategy. State coordinating fora which consist of state oxygen desk and partners working at sub-national level also play a critical role in ensuring that investments and interventions in the states are well coordinated to ensure equitable access to medical oxygen.

The FMoH and NPHCDA will provide overall leadership at the national level to ensure progress towards implementation of the National Strategy. The FMoH and NPHCDA will be responsible for updating national policies, clinical guidelines, regulations, and other standards, and disseminating them to relevant stakeholders for implementation. Additionally, FMoH has created an oxygen desk within the ministry to lead the activities of the national coordinating mechanism (U4O) and to support state oxygen desks and coordinating fora for the scale-up of oxygen therapy in the country. The coordinating mechanism will comprise of a multi-disciplinary team consisting of, but not limited to biomedical engineers/technicians, pharmacists, nurses and doctors from the public and private sectors, academia, and development partners.

SMoH and relevant agencies (SPHCB, SHMB) will work at all levels of care (THF, SHF, PHC) to adopt national guidelines and policies and oversee the delivery of pulse oximetry and appropriate oxygen delivery systems in health facilities. This will include procurement and planning, allocation of state resources, development of maintenance and technical support systems, training and supervision for health providers, technicians, and Quality Improvement Teams (QITs). These QITs will be multi-disciplinary, and accountable to the Chief Medical

Director (CMD/MD) for tertiary facilities; Medical Officer-in-Charge for state run secondary facilities; or Officer -in-Charge at primary healthcare centres. The multi-disciplinary state coordinating mechanism for oxygen therapy scale-up will be led by the oxygen desk at SMoH.

7.2 Roles and Responsibilities

The success of the implementation of the National Strategy relies on contributions from both the public and private sector and is contingent on each stakeholder group having a clear understanding of its role. The following presents a brief description of the main contributions that identified stakeholders will make to successfully scale-up oxygen therapy in Nigeria.

Federal Ministry of Health

i. Disseminate national guidelines (EML, EEL, NSTG), clinical guidelines, regulations, and National Strategy for oxygen delivery systems to relevant stakeholders for implementation.
ii. Work with regulatory agencies (NAFDAC, SON) to update regulations to clarify registration and importation requirements for oxygen supply equipment and diagnostics meeting international standards (e.g., WHO specifications)
iii. Support states to establish oxygen desk.
iv. Lead fundraising efforts for the strategy and galvanise funding commitments from other MDAs including revenue generating agencies.
v. Facilitate annual review meetings with stakeholders.
vi. Promote standards for quality clinical practice.
vii. Improve monitoring and evaluation by strengthening reporting on hypoxaemia and medical oxygen use to relevant national platforms.

National Primary Health Care Development Agency

i. Disseminate relevant national guidelines (NSOs) to State Primary Healthcare Board and Agencies for dissemination to PHCs in the states.
ii. Contribute to national coordinating mechanism (U4O) for medical oxygen scale-up.

State Ministry of Health

i. Conduct training and provide technical support for planning, implementation and monitoring implementation of the oxygen plan and proper oxygen delivery system at the LGAs and PHCs.

ii. Allocate state resources to promote adequate supply and distribution of key commodities for oxygen use to health facilities.
iii. Depending on oxygen supply mix, SMoHs should ensure that requisite power supply and dependability is reflected in the design and decision-making process.
iv. Strengthen referral network between different levels of facilities (Communities, PHCs, SHFs, THFs and the private sector).
v. Organise and lead state coordinating mechanisms for medical oxygen.
vi. Lead fundraising efforts for scale-up of interventions and equipment maintenance.
vii. Improve monitoring and evaluation by strengthening reporting on hypoxaemia and medical oxygen use to relevant state platforms.

Private Medical Facilities and Not-for–profit Mission Hospitals

i. Support Continuing Professional Development (CPDs) and training of health personnel on medical oxygen use.
ii. Support dissemination and compliance with clinical guidelines on hypoxaemia management.
iii. Ensure appropriate referrals to next level facilities and establish linkages with public facilities and relevant SMoH structures.
iv. Foster a strong and functioning culture of maintenance of oxygen devices, including the use of maintenance records.
v. Improve monitoring and evaluation by strengthening reporting on hypoxaemia and medical oxygen use to relevant state platforms.

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ANNEXES

A: Specifications for Pulse Oximeters, Oxygen Concentrators and Relevant Accessories

Disclaimer:

This National Strategy for the Scale-up of Medical Oxygen in Health Facilities is intended to provide states/facilities with overall high-level guidance in developing their strategy for scale-up. Specifications for pulse oximeters, oxygen concentrators and relevant commodities provided herein are to serve as a reference only and are based on current globally accepted standards. Therefore, the specifications in the strategy are intended to guide the identification and evaluation of potential high-quality equipment for procurement. Decisions on the selection of specific brands and devices will be left to states during their own tendering and procurement processes.

There are four categories of pulse oximeters—benchtop, handheld, fingertip, and mobile device (see Figure 1). Both fingertip and handheld oximeters are portable, and the latter are more durable. Benchtop pulse oximeters are mostly used in operating theatres and intensive care units, though some models of handheld pulse oximeters have this functionality as well. When maintained in good condition, pulse oximeters can have a lifespan of up to eight years. Components such as sensor probes and wiring are the most [12] prone to damage and account for the high failure rate of pulse oximeters. [13]

Overview of Pulse Oximeters

	Stationary/benchtop	Handheld	Fingertip	Mobile device
Monitoring Parameters	SpO_2 HR Blood pressure Optional: Respiratory rate ECG Temperature $ETCO_2$	SpO_2 HR (*some have additional features such as $ETCO_2$) Respiratory rate	SpO_2 HR	SpO_2 HR
Use-case	Continuous monitoring	Diagnostic/ spot-check	Diagnostic/Spot-check	Diagnostic/Spot-check

Additional equipment required	· Age-specific probes should be purchased. Probes need replacing after +/- 1 year. BP cuffs and backup battery	· Age-specific probes should be purchased. · Probes need replacing after +/- 1 year. Replacement batteries.	· Device itself is age-specific, Few fingertip models are for paediatric populations, and fingertip models are not suitable for neonates. multiple will be needed. Replacement batteries. BP cuffs and backup batteries	· Age-specific probes should be purchased. Probes need replacing after +/- 1 year.
Additional information for decision making	· Need for mains (though internal emerge. battery for some autonomy) · More durable Not portable unless on trolley	· More alarms and internal memory than fingertip devices · Some devices have rechargeable batteries, others disposable · More durable Portable	· No internal memory · Basic requirements met · Some devices have rechargeable batteries, others disposable · Less durable · Portable	· No need for electricity · Runs on mobile device battery · Measurements and data can be shared via email Portable

In the absence of globally accepted specifications for pulse oximeter devices, information contained herein draws from the Global Pulse Oximetry Project (a WHO initiative, 2008) [27] as well as relevant WHO and ISO specifications. It is to serve as a guide, providing a targeted list of considerations for product verification and/or selection. This guide starts with general criteria, listing features that all pulse oximeter devices must have, followed by desirable criteria that should be in place, but that are not mandatory for functionality. Criteria for specific device types, as presented in Annex B, are listed in the table below general criteria.

ALL pulse oximeters must:

- Meet all relevant ISO 80601-2-61:2011 criteria (former ISO 9919) IEC 60601-1-1 Medical electrical equipment – Part 1-1: General requirements for safety – Collateral standard: Safety requirements for medical electrical systems. IEC 60601-1-2 Medical

electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral standard: Electromagnetic compatibility – Requirements and tests. IEC 62133 – Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells. Part 1: Nickel, Part 2: Lithium. (If applicable)

- Carry a CE mark and/or FDA approval must also have ISO 13485 certification.
- Have audible* and visual display alarms for low oxygen saturation and battery levels.
- Be pre-programmed to measure arterial oxygen saturation (SpO_2) between clinically relevant limits (e.g., of 70-99%) with an accuracy of within ± 2% under ideal conditions of use, and within ± 3% for all patients and perfusion/movement conditions. Note that fingertip devices are unlikely to have +/- 2% accuracy.
- Be pre-programmed to measure pulse rates between clinically relevant limits (e.g., between 30-240 beats per min, bpm) with an accuracy of ± 3 bpm. Additional display pulse rates numerically and with a plethysmograph** (in waveform and/or bar graph) % SpO2, battery status, and sensor error/signal fault
- Are reusable and/or have reusable sensors/ probes sized for adults, children, and neonates.
- Have power adaptor to be Type-B AC (British standard) and operate at 240 V, 50 Hz. (Not applicable for battery powered devices)
- Work reliably at temperatures up to 40°C and ≤ 95% relative humidity.
- Have a minimum 1-year warranty on the equipment provided in detail
- Be simple and intuitive to use
- Have back-lit screen with large readouts on the display screen that are visible in dim lighting
- Have robust probes and sturdy wiring to withstand heavy use
- Have differential alarm if it takes longer than 30 secs to detect next pulse value.

In addition, it would be desirable for the pulse oximeter to have an IPX1 Per WHO spec, IPX2 or better is recommended. Ingress protection rating, as a minimum, according to IEC (e.g., in the case of bodily fluid spills and for regular cleaning).

Additional specifications for pulse oximeter types:

Type	Additional specifications
Tabletop	· Must have 3-hour operational capacity on rechargeable built-in battery and take no more than 7 hours to charge. Ideally have internal memory to store at least 99 IDs with up to 200 records/ID, and a port for downloading and/or printing.
Handheld	· Must have ≥ 6-hour operational capacity on rechargeable built-in battery and take no more than 10 hours to charge or use standard size disposable batteries. · Ideally be portable (≤300 g) and easily hand-held. Ideally have internal memory to store at least 99 IDs with up to 200 records/ID, and a port for downloading and/or printing.
Fingertip	Must use standard sized rechargeable or disposable batteries (e.g., AAA).
Mobile device	Must be compatible with various mobile device operating systems (iOS, Android).

* Audible not necessary on fingertip pulse oximeters

** Plethysmograph not necessary on fingertip pulse oximeters.

OXYGEN CONCENTRATORS [28]

- Declaration of conformity to ISO 80601-2-69:2014 (or adhere to the three-year transition period from ISO 8359:1996) Carry a CE mark and/or FDA approval as other documents (not 510k clearance) must also have ISO 13485 certification.
- Be capable of delivering a continuous flow of oxygen at a concentration ≥85% (±3%)
- Be equipped with at least one built in flowmeter with flow rate control capable of delivering 0.5 LPM as a minimum and be able to increase by 0.5 LPM increments to a 5 LPM, 8LPM, and 10LPM maximum-rated flow.
- Provide a flow rate from the device that must not exceed the maximum rated flow rate and be capable of generating oxygen at 55 kPa (or higher) at all flows.
- Context specific environmental requirements: capable of delivering and maintaining the minimum oxygen concentration at the specified maximum flow rate of the concentrator at 40°C and 95% relative humidity (RH).
- Have alarms indicating when:
    - Oxygen concentration falls below 82%

- Low flow
- High or low pressure
- Power supply failure
- High temperature

Have removable particle filters incorporated to prevent dust ingress. Particle filter must also be hand washable. In addition to gross particle filter, filter assembly must include:

Air intake (compressor) filter - an internally mounted filter which shall be replaced at a manufacturer-prescribed frequency but adapted to local needs.

A product (bacteria) filter - an internally mounted filter to be replaced at a manufacturer-prescribed frequency but adapted to local needs.

- Produce no more than 50 dB(A) of noise when in operation.
- Have a power efficiency of not more than 70 W/LPM and have a Type-B AC (British standard) power plug (or include an adapter) and operate at 240 V, 50 Hz B (or include a converter).
- Have a meter (digital or analogue) that displays cumulative hours of device operations.
- Have (option for) 5-year manufacturer's warranty.

FLOWMETER ASSEMBLY

A flowmeter (flow splitter or flow station) assembly should be considered for sharing oxygen from one concentrator, along individual lines, between multiple neonatal or paediatric patients. These should consist of:

- Up to 5x 0-2L/min flowmeters
- Ability to titrate to 0.1L/min, ±5% of full scale

OXYGEN ANALYZER

- Must specify sensor type. Galvanic analysers can be used to check purity of PSA and LOX sources; ultrasonic analysers can only be used to test purity of PSA sources. Given the purity range noted and use case (concentrators), appears this section is referring to analysers with ultrasonic sensor. per WHO specification:

- Works reliably at temperatures up to 40°C and ≤ 95% RH.
- Must measure and display clearly: Oxygen purity: 21%-95.6% ± 1.5%,
- Compatible for use with oxygen concentrator device listed in tender and include necessary attachments/tubes.
- The device should have a 2-year warranty provided in detail on both analyser and sensor.
- Oxygen analysers are regulated as medical devices thus CE or FDA approval as well as ISO 13485 certification is required.

Desirable:

- Accuracy +/- 3%; Battery life > 250 hours; Sensor life >= 1.5 years
- Oxygen flowrate: 0-10 LPM ±0.2%
- Patient output pressure: 5-350 kPa. Complies with the current European Pharmacopoeia monograph (0417) or equivalent. Nominal valve outlet pressure: 137 bar
- White shoulder as a minimum or all-white tank.
- Compatible pressure regulator and gauges (inlet/outlet)
- Compatible flow meter and gauge
- Compatible humidifier
- All components must be rated for use with oxygen.

B. Suggested Reading for Health Administrators and Other Stakeholders

Clinical Use of Oxygen in Hospitals

(Source: WHO, 2012)

Guidelines for health-care workers, hospital engineers and managers on the clinical use of oxygen in hospitals with limited resources. Key information provided around hypoxaemia, giving oxygen, oxygen systems in hospitals, diagnosis of hypoxaemia, humidification, and principles of managing a national or regional oxygen programme. http://video.rch.org.au/cich/The_Clinical_Use_of_Oxygen_November_2011.pdf

Oxygen Therapy for Children

(Source: WHO, 2016)

A practical bedside manual for health workers to guide the provision of oxygen therapy for children supporting improved use and availability in low resource settings. Focused on appropriate detection of hypoxaemia and use of pulse oximetry, oxygen delivery systems and monitoring of patients on oxygen therapy. Additionally, the manual addresses practical use of pulse oximetry, and oxygen concentrators and cylinders. http://apps.who.int/iris/bitstream/10665/204584/1/9789241549554_eng.pdf

Technical Specifications for Oxygen Concentrators

(Source: WHO, 2015)

A WHO-produced guidance document for the appropriate selection, procurement, utilization and maintenance of oxygen concentrators and necessary accessories. Efforts in doing so holistically are to increase the availability, management and quality of oxygen concentrators for an overall improvement in health outcomes in LRS. http://apps.who.int/medicinedocs/documents/s22194en/s22194en.pdf

UNICEF Oxygen System Planning Tool

The Oxygen System Planning Tool (OSPT) is an excel-based, customizable tool that can be used to plan oxygen delivery systems from source to patient. This tool can be used to support high-level healthcare budgeting and planning needs related to oxygen, including health and procurement specialists and oxygen technology stakeholders.

The tool uses health facility-level input data and customizable country input parameters to calculate oxygen needs. With the relevant data from users, the Oxygen System Planning Tool recommends an oxygen source to meet those needs (i.e., a new local oxygen plant, liquid oxygen, concentrators, cylinders from a distant plant, or a mix). The excel-based tool can help users develop multiple scenarios of oxygen infrastructure to compare CAPEX/OPEX cost, demand, resource re-allocation, and other key outcomes noted below.

PATH Quantification and Costing Tool

The *Quantification and Costing Tools* are Excel-based resources that quantify the potential need for oxygen and pulse oximeters; based on these estimates of need, they calculate the anticipated costs over time for meeting this need with different device types.

Clinical Management of COVID – 19 (WHO)

WHO *COVID-19 Clinical management: living guidance* contains the most up-to-date recommendations for the clinical management of people with COVID-19. Providing guidance that is

comprehensive and holistic for the optimal care of COVID-19 patients throughout their entire illness is important. The **latest version** is available in pdf format (via the 'Download' button) and via an online platform, and is updated regularly as new evidence emerges.

v.11_20167_WHO Priority medical devices list for COVID-19 response

This document describes the medical devices required for the clinical management of COVID-19, selected and prioritized according to the latest available evidence and interim guidelines. This includes: oxygen therapy, pulse oximeters, patient monitors, thermometers, infusion and suction pumps, X-ray, ultrasound and CT scanners as well as personal protective equipment.

C: Terms of Reference for the United 4 Oxygen Coalition

Background

The United for oxygen (U40) coalition is a global public-private partnership established to reduce death among children under 5 and pregnant women by improving access to medical oxygen and pulse oximetry. The consortium comprises government, industry, NGOs, and civil society organizations supporting the government of Nigeria's efforts to implement its national strategy across the country. Based on successful implementation of this flagship, the United for Oxygen (U4O) will continue to serve as the national coordination mechanism for medical oxygen in Nigeria. Led by the FMoH the United for Oxygen coalition coordinates all efforts and interventions to improve oxygen access in Nigeria. and link up with the national and global partners and/or bodies for the needed technical support to guide efforts and decision making for oxygen and provide regular feedbacks on progress.

A. The National Coordinating mechanism (UNITED FOR OXYGEN)

FMoH shall collaborate with the SMoH to ensure full implementation and adoption of the strategy to maximize use of resources, promote synergies and avoid duplication.

The U4O will serve as the national coordination mechanism for medical oxygen ecosystem in the country with the oxygen desk, Department of Hospital Services of the Federal Ministry of Health serving as the secretariat. U4O will be chaired by the Head of the Department of Hospital Services. He or She will report directly to the Honourable Minister of Health. The Secretariat will be crucial in organizing activities of the U4O to effectively implement the National Oxygen Strategy in the country. To deal with other sub-functions, the U4O will have three sub-committees namely.

- Advocacy and Resource Mobilization,
- Monitoring, Evaluation, Accountability and Learning,
- State Support.

The sub-committees are responsible for taking the lead on the implementation of the National medical oxygen Strategy. They consist of technical officers from component programmes of the Fede ral Ministry of Health, relevant MDAs, as well as partners.

The secretariat will function as the daily operational arm of U4O and shall be responsible for supporting meetings, executing the plans and decisions of all the subcommittees.

Membership of the U40

To coordinate medical oxygen, scale up efforts, the Federal Ministry of Health convenes a U4O steering committee of relevant in-country stakeholders. The committee meets in-person twice in a year to review implementation progress, with ongoing communication in the interim to share updates, materials and lessons-learned across relevant stakeholders. Membership includes:

- Honourable Minister of Health (Chair)
- Director, Department of Hospital Services, FMoH
- National Oxygen Desk (Secretariat)
- Representatives of relevant departments and agencies (e.g., Family Health Department, NAFDAC, NPHCDA, SON etc)
- State Oxygen Desk Officers (for state-level coordination and support)
- Implementing partners
- Private sector including representatives of oxygen plant manufacturers, suppliers, and distributors.

Roles and Responsibilities of U40

- Coordinate the implementation of the National Strategy for the Scale-up of Medical Oxygen in Health Facilities by providing a platform for the joint planning and review of individual scale-up interventions—including the development and harmonization of interventions at National and State levels.
- Maintain an updated database of partners, activities, and interventions engaged in the implementation of the National Strategy for the Scale-up of Medical Oxygen in Health Facilities.
- Monitor implementation of scale-up interventions by coordinating in-person meetings twice in a year to review progress, address barriers, and share lessons.
- Provide a platform for frequent and transparent information and knowledge sharing across stakeholders.
- Identify needs and address gaps for successful implementation of the National strategy by engaging potential partners and/or resources to fill these gaps.
- Advocate for additional public- and private-sector investment to scale-up interventions at national and state levels.
- Directly contribute to expanded oxygen access in Nigeria per each organization's specific partner commitment.

Functions of the U4O Subcommittees

I. Advocacy and Resource Mobilization

- Develop advocacy plans.
- Develop tools, organize high profile advocacy activities/missions, promote messages to create awareness and mobilize support for access to medical oxygen.
- Mobilize resources.

II. Monitoring, Evaluation, Accountability and Learning (MEAL)

1. Develop a monitoring and evaluation framework with timelines.
2. Review and update integrated tool for supervision, monitoring and evaluation.
3. Develop a functional mechanism for supervision, monitoring and evaluation.
4. Review and monitor stakeholders' delivery on commitments.
5. Support data management and dissemination of information.
6. Support the National/State bi-annual review meeting.
7. Coordinate community of practice for medical oxygen use.
8. Support research efforts for medical oxygen.

III. State Support

- Review and support implementation and roll-out of the national oxygen strategy
- Support establishment of new State coordinating fora and strengthen existing partnership.
- Support States to institute periodic needs assessment for implementation and progress review of the national oxygen strategy.
- Support capacity building for programme management and service delivery.

B. State Medical Oxygen Coordinating Forum

The State Medical Oxygen coordinating forum will serve as the sub-national coordination mechanism for medical oxygen ecosystem in the state. The oxygen desk, at the State Ministry of Health serving as the secretariat. It will be chaired by the Director of Medical/Clinical Services. The State Government will follow the same guidelines as those presented above in establishing this coordinating forum including its subcommittees. Members will meet periodically to review implementation of oxygen programmes in the state. The LGA level will be supported by the state coordination, ensuring that all laid-out activities are performed as and when due. The three State-level committees will superintend the LGA implementation.

Membership of state oxygen coordinating forum:

- The Honourable Commissioner for Health – Chair
- Director of Medical Services
- Executive Secretary, HMB
- Executive Secretary, SPHCB
- Oxygen Desk, SMoH (Secretariat)
- Representatives of relevant departments and agencies (e.g., DPRS, SPHCB, NAFDAC, SON etc)
- Private sector including representatives of oxygen plant manufacturers, suppliers, and distributors.

- Chief Medical Directors of tertiary institutions
- Implementing Partners, Donors

Functions of the state coordinating forum

- Adopt/Adapt national implementation strategy to scale up supply and distribution of medical oxygen and diagnostics across health facilities in the state, by providing a platform for collaboration and joint planning amongst stakeholders in the state.
- Coordination, monitoring and mapping of interventions implemented in the state by various partners and organizations as well as appropriate monitoring and evaluation these interventions.
- Identifying sustainable financing to support procurement, installation, and maintenance of the state oxygen equipment and facilities and for the integration of oxygen in relevant health programmes.
- Advocacy for additional public- and private-sector investment to scale-up interventions across all levels.
- Coordination of all capacity building efforts for health workers, biomedical engineers, and quality improvement teams on the use and maintenance of oxygen devices and equipment; including development of training materials and/or facilitation of training.
- Identifying needs and/or gaps for scaling up implementation and engaging potential partners and/or resources to fill these gaps on behalf of the state.
- Provision of technical assistance to assess needs and to identify optimal oxygen delivery systems at the facility-level.
- Provision of a platform for frequent and transparent information and knowledge sharing across stakeholders.
- Direct contribution to expanded oxygen access in the state per each organization and stakeholders' specific commitment.

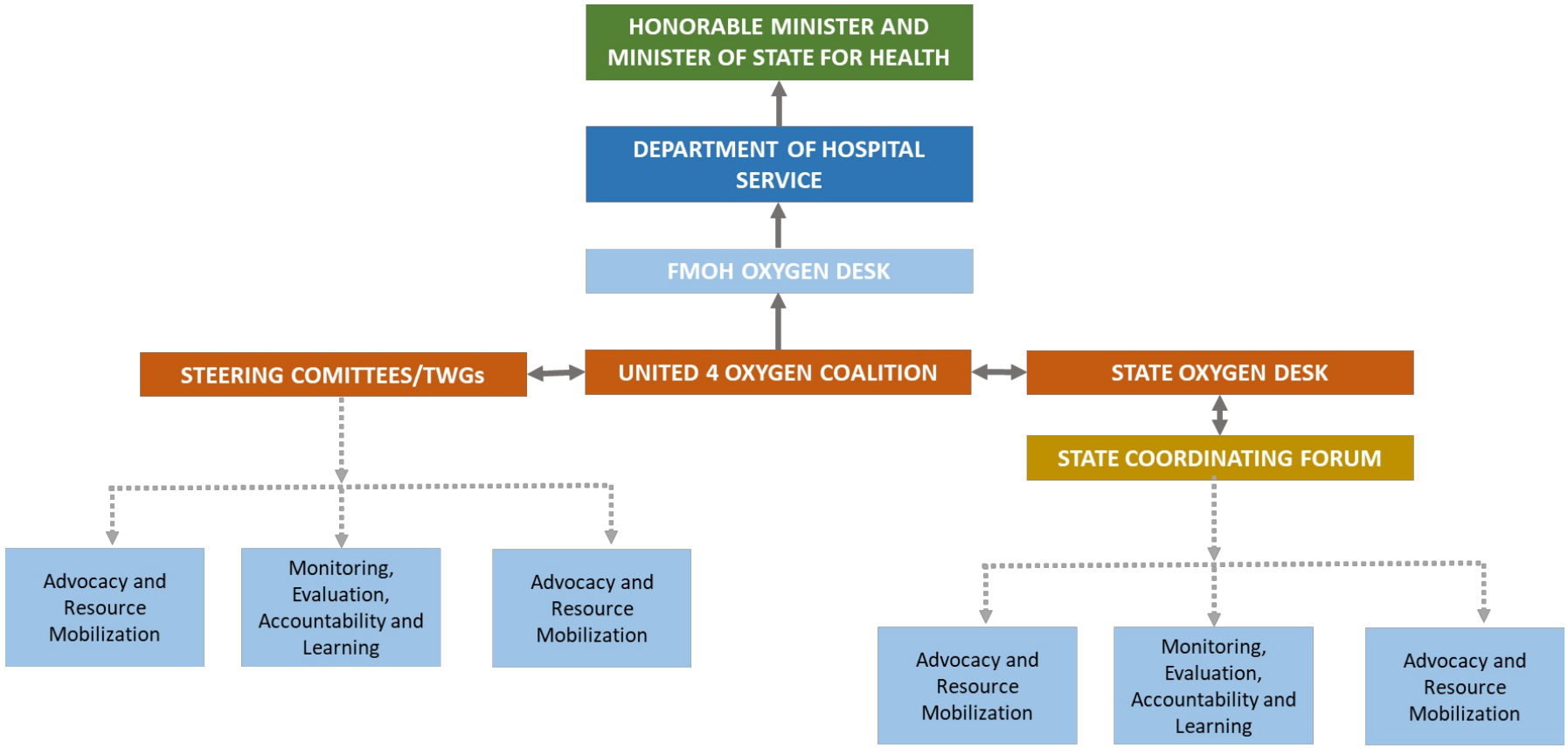

FIGURE 11: NATIONAL OXYGEN COORDINATION STRUCTURE AND FUNCTIONS

D: Indicator Reference sheet

Indicator		Operation Definition	Source	Frequency	Level of Measurement	Responsible Person
Impact						
1	Under-five mortality rate (deaths per 1,000 live births) in the target states	*Numerator:* Number of deaths among children under five (0-59 months of age *Denominator:* Total number of live births (person-years of exposure)	Survey	Track with DHS or with DHIS	Population	National Oxygen Desk
Outcome						
2	Proportion of death due to hypoxaemia	**Numerator:** Number of death due to hypoxaemia **Denominator:** Number of deaths by all causes.	Patient registers Case notes	Annual	National	FMoH
3	Proportion of patient screened with pulse oximeter at initial assessment. *(Disaggregated by Sex, Age, Wards etc)*	**Numerator:** Number of outpatients with a SpO_2 measurement charted on the patient's assessment form **Denominator:** Number of outpatients attendance	Patient card/case notes NHMIS register	Annual	National	FMoH
4	Proportion of patients with documented SpO_2 < 90% at initial assessment *(Disaggregated by Sex, Age, Wards etc)*	**Numerator:** Number of patients with SPO_2<90% at initial assessment. **Denominator:** Number of patients assessed/screened using pulse oximeter	Outpatient registers Case notes	Annual	National	FMoH
5	Proportion of patients with pulse oximeter reading SpO_2 <90% who were referred for admission/in patients care	**Numerator:** Number of patients with SpO_2<90% who were referred for admission/inpatients care. **Denominator:** Number of patients with SpO_2 <90%	Patient registers	Annual	National	FMoH

6	Proportion of patients with SpO_2 < 90% referred for inpatient care/admission from other health facilities *(Disaggregated by Sex, Age, Wards etc)*	**Numerator:** Number of patients with SPO_2<90% who were referred for admission/inpatients care from other health facilities **Denominator:** Number of patients with SPO_2 <90%	Referral registers Patient register	Annual	National	FMoH
7	Proportion of hypoxaemic patient that received medical oxygen therapy *(Disaggregated by Sex, Age, Wards etc)*	**Numerator:** Number of hypoxaemic patients that received medical oxygen therapy **Denominator:** Number of patients with an SpO_2<90%	Inpatient care register Patient case note	Annual	National	FMoH
8	Mean duration of medical oxygen therapy	N/A		Annual	National	FMoH
9	Proportion of states implementing planned preventive maintenance (PPM)	**Numerator:** Number of states implementing planned preventive maintenance (PPM) **Denominator:** Number of states with a planned preventive maintenance (PPM) plan	Oxygen inventory management system	Annual	National	FMoH
10	Proportion of health facilities that report medical oxygen indicators using medical oxygen data repository or DHIS 2.	***Numerator:*** Number of health facilities that reports medical oxygen data based on the national definition for oxygen specific indicators. **Denominator:** Total number of health facilities.	NHMIS Medical Oxygen Data Repository (MODR)	Annual	National	FMoH
11	Proportion of state with sustainable	***Numerator:*** Number of states with a functional	AOP implementation tracker	Annual	National	FMOH

	financing for medical oxygen (e.g., AOP)	financing model for medical oxygen **Denominator:** Total number of states				
Indicator			**Data Source**	**Frequency**	**Level of Measurement**	**Responsible Person**
Output						
Objective 1: To Improve Governance, Strengthen Coordination and Strategic Partnerships for Oxygen Access and Scale-up in the Country						
12	Number of dissemination of meetings conducted		Minutes of meeting	Annual	National	FMoH
13	Number of quarterly U4O meetings conducted		Minutes of meeting	Annual	National	FMoH
14	Number of states with oxygen desk		List of state's Oxygen desk	Annual	National	FMoH
15	Number of states with functional oxygen co-ordinating forum		List of state's Oxygen desk Minutes of meeting	Annual	National	FMoH
16	Number of states with oxygen desks that participate in the bi-annual review meetings		Attendance sheets Review meeting report	Annual	National	FMoH
17	Desk review of selected national guidelines conducted to assess medical oxygen inclusion.		Minutes of meeting	Annual	National	FMoH
Objective 2: **Increase Availability and Quality of Oxygen Technologies and Supplies at all Levels through Strengthened Oxygen Procurement and Distribution Systems**						
18	Number of oxygen quantification and forecast conducted		List of medical oxygen commodities quantified Essential Medicine List Essential Equipment List	Annual	National	FMoH
19	Documents for procurement, distribution, and donation of oxygen technologies & commodities developed.		Minutes of meeting	Milestone	National	FMoH
20	Database of suppliers of oxygen related technologies and services developed.		Database of suppliers	Annual	National	FMoH
21	Total cost of ownership model developed.		Minutes of meeting Developed guideline	Milestone	National	FMoH
22	Number of state procurements made in line with procurement plan		Procurement orders	Annual	National	FMoH
23	Inventory management system for oxygen equipment developed		Inventory management system	Annual	National	FMoH
24	Number of National SOPs for planned preventive maintenance (PPM) developed and disseminated.		Planned Preventive Maintenance (PPM) SOPs		National	FMoH

25	Number of states that implement planned preventive maintenance (PPM) plan.	PPM visit reports	Annual	National	FMoH
Objective 3: Improve Clinical Administration and Technical Management of Oxygen at the Facility-Level					
26	Clinical guidelines for the management of hypoxaemia developed	Clinical guidelines for hypoxaemia	Milestone	National	FMoH
27	Number of states where clinical guidelines for the management of hypoxaemia has been disseminated	Report of dissemination meeting		National	FMoH
28	Number of HCW/BMETs trained on oxygen utilization and oxygen equipment maintenance	Trainee database	Annual	National	FMoH
29	Integrated Supportive Supervision (ISS) tool reviewed and updated with medical oxygen indicators.	ISS dashboard	Annual	National	FMoH
30	Number of supportive supervisions conducted.	Supervision visits reports	Annual	National	FMoH
Objective 4: Increase Sustainable Financing for Oxygen Access					
31	Domestic resource mobilization strategy for medical oxygen investments developed	Report of meeting Domestic resource mobilization strategy	Milestone	National	FMoH
32	Number of states with costed annual operational plan that includes medical oxygen	Annual Operational Plan	Annual	National	FMoH
Objective 5: Improve Data, Information Systems and Monitoring for Oxygen Ecosystem					
33	Medical Oxygen Data Repository (MODR) developed	Report of meeting	Milestone	National	FMoH
34	Number of health facilities that report medical oxygen data through the medical oxygen data repository or DHIS 2.	DHIS 2/MODR	Annual	National	FMoH
35	Number of medical record officers, oxygen desk officers, and LG M&E officers trained on the use of medical oxygen data tools.	Trainee database		National	FMoH
36	Number of medical record officers, oxygen desk officers and LG M&E officers trained on the use of medical oxygen data repository (MODR) or DHIS for medical oxygen.	Trainee database		National	FMoH
37	Number of states that conducted quarterly DQA.	DQA reports DQA dashboard	Annual	National	FMoH
38	Number of periodic (monthly, quarterly & annually) meetings conducted to review medical oxygen data.	Data Review meeting reports	Annual	National	FMoH
39	Midterm review of the implementation of National strategy on scale-up of medical oxygen conducted	Report	2 yearly	National	FMoH
40	End-line review of the implementation of the national strategy on the scale-up of medical oxygen conducted	Report	At year 5	National	FMoH

41	Online national oxygen data repository for research findings developed	Research data repository developed	Annual	National	FMoH
42	Number of medical oxygen-related learning sessions held	Meeting reports	Annual	National	FMoH
43	Community of practice for medical oxygen use established.	Meeting reports	Annual	National	FMoH
44	Number of oxygen-related research funded by FMoH and partners.		Annual	National	FMoH

E: Directory of State Oxygen Desk Officers

S/N	State	Full Name	Email Address
1	Abia	Dr. Rosemary Ajah	ajahrosemary24@gmail.com
2	Adamawa	Dr. Nuhu Tari	dedoctor@gmail.com
4	Anambra	Mr. Chizoba Nwabachili	franklinchizoba25@yahoo.com
3	Akwa Ibom	Dr. George Ekanem	obonggeorge9@gmail.com
5	Bauchi	Dr. Ibrahim Tijjani Bashir	teejat54@gmail.com
6	Bayelsa	Dr. Gbanailou Orukari (Rep Binta Bala)	gbanaio@gmail.com
7	Benue	Nil	Nil
8	Borno	Engr. Mustapha Habeeb	ajiramme2020@gmail.com
9	Cross River	Patrick Odu	patoos99@gmail.com
11	Ebonyi	Dr. Charles Alike	Charlesalike@gmail.com
12	Edo	Dr. Ojiefo Stephenson	prsteveoje@yahoo.com
13	Ekiti	Nil	Nil
14	Enugu	Dr. Uche Joel Okenwa	jokenwauche@gmail.com
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21	Katsina	Dr. Ma'awuya Aliu	aliumaawuya@gmail.com
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24	Lagos	Dr. Ajayi Tunde	drtundeajayi@gmail.com
25	Nasarawa	Dr. Usman Tanke	Usmanabubakartanze@gmail.com
26	Niger	Alexander Mark Bawa	alexmark138@gmail.com
27	Ogun	Dr. Olubusayo Olayinka	olaoluby@gmail.com
28	Ondo	Dr. Adelusi Ayodele Victor	adelusiking@yahoo.com
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30	Oyo	Dr. Olubunmi Ayinde	jummsyp@yahoo.com
31	Plateau	Dr. Samuel Audu Kwarsen	askwarsen@gmail.com
32	Rivers	Dr. Patrick Foster Azubuike	lito4surg@gmail.com
33	Sokoto	Dr. Ahmed Saidu Maishanu	amaishanu@gmail.com
34	Taraba	Dr. Micah Musa Madaki	mmmadaki@yahoo.com
35	Yobe	Dr. Abdulhamid Gulani	abdulgulani20@gmail.com
36	Zamfara	Engr. Aliyu Garba	unitedbiomedicalventure@gmail.com

F: Names of FMoH Staff and respective States per geopolitical zone for support

S/No	Names of SMoH Staff	Scope of coordination/support	Contact Details
1	Eno Edem Igabo	South-South	eno_edem@yahoo.com
2	Emmanuel Bishara	North-East	emabishara@gmail.com
3	Ajayi Abimbola	South-East and South-West	aabimbola98@yahoo.com
4	Dr Abdulazeez Abbas	North-West	abdulazeezabbas2014@gmail.com
5	Kingsley Onoja	North-Ccentral	omaking2014@gmail.com

G: Mapping of relevant Policies and programmes that can be leveraged

Programme	Description
Basic Health Care Provision Fund (BHCPF)	1. BHCPF is aimed at increasing funds to improve the delivery of primary health care (PHC) services, the Basic Minimum Package of Health Services (BMPHS), and emergency medical treatment. 2. BHCPF derives from the National Health Act (2014) but was launched in 2018 with the roll out of six states: Osun, Abia, Niger, Yobe, Borno, and Edo. So far, 28 states have indicated interest. Once a state meets all readiness criteria, the programme would be launched in that state. 3. Funding: the federal government has reserved $151 million; BMGF has contributed $2 million, with a $75million commitment over five years; GFF has committed $20 million; and DFID is committing $65 million over the next 5 years. Although states have to express interest with N100 million, states are also encouraged to contribute to the funding. 4. Current health priorities: reproductive, maternal, child, adolescent health plus nutrition, non-communicable diseases screening, and emergency services Activities funded under the BHCPF include essential drugs and vaccines; maintenance of facilities and equipment, improved human resource for health, essential new-born care, etc.
NHIS/SHIS	• Launched in 2005, the NHIS is aimed at providing affordable access to universal health care via pooled financial prepayments, that reduce financial risk against high health care costs the federal government sets the standards and guidelines, while enforcing the obligations and protecting the rights • of all stakeholders • The programs span across three categories: the formal sector, the informal sector, and vulnerable groups • Depending on the program- the federal, state, or local governments, employers, employees, development partners, and civil society organizations will make prepayments into the programme fund Health Maintenance Organizations act as intermediaries between the NHIS and hospitals that provide health service. • National Health Insurance Act: • Ten states have replicated the NHIS and launched SHIS. These include Lagos, Delta, Ekiti, Kaduna, Sokoto, Abia, Anambra, Kwara, Kano, and Imo
Global Financing Facility (GFF)	• GFF is a funding solution dedicated to women, children, and adolescent health. • In Nigeria, GFF funding is focused on the delivery of health service GFF grant of $51 million was given to Nigeria in 2018 • The first phase of the GFF grant (2017 to 2030) will be used to scale up reproductive, maternal, new born, child, and adolescent health services in areas of humanitarian crisis and emergency response in six states: Yobe, Taraba, Gombe, Borno, Bauchi, and Adamawa • The second phase of the GFF grant (2018) will be used for maternal, new born, and child health (MNCH) services within BMPHS in Abia, Niger, and Osun state
Basic Minimum Package of Health Services (BMPHS)	• BMPHS is a list of preventive, protective, promotive, curative and rehabilitative health services and interventions that should be available in every health facility. • It is published by the Minister of Health

	• BMPHS consists of nine interventions that focus on maternal health, care for children U5, non-communicable diseases, and emergency treatment of road traffic injuries. The aim is for all Nigerians to receive these services completely free
IMCI	• IMCI is an integrated child health approach focused on the well-being of children. It aims to reduce U5 morbidity and mortality from pneumonia, malaria, diarrhoea, measles, and malnutrition. Health workers are trained to conduct holistic assessments of sick children, rapid referrals of severely ill children, and • appropriately use medicines in PHC facilities • IMCI also improves the skills and knowledge of community workers IMCI can be delivered in both an outpatient health facility setting, and in a home setting

H: Current partner and Government activities

STAKEHOLDER	FUNDER	ACTIVITY OR PROJECT	COMMENTS
FMoH	**GON**	1). PSA rapid functionality assessment conducted in 2020 2). Planning and advocacy for DRM for 38 PSA plants + distribution planning 3). Distribution planning for PSA plants 4). Repair of 6 non-functional oxygen plant 5). Procurement and installation of 13 oxygen plants, 6 are fully operational in country (2 NW- Kano &Katsina; Ebute meta, Owo and Ife, Maitama, (Jos and Bauchi, Enugu and Asaba; Jalingo, Irrua, FMC Keffi)	Procurements did not make adequate provision for plant housing, dedicated power supply. Trying to structure 2-year SLAs. CHAI is using some funding from ACT-A for dedicated generators for prioritized facilities/PSA plants (6 generators). Unclear when these PSA plants will come on board.
OLI	**GON/GSK**	1). Capacity Building of Health workers pulse oximetry and hypoxaemia management	
	Spark Health Design, USA	2). Partnering with CBHD for a user perspective assessment of effectiveness of oxygen concentrators	
	JAC Foundation, Australia	3) Provision of oxygen equipment for HFs in Nigeria	
		4) Maintenance of oxygen concentrators in HFs	
CHAI	**BMGF - LAGOS STATE**	1). PSA plant in IDH Hospital, Lagos 2). Construction and delivery of four oxygen kiosks in Lagos state	Transitioned operations of the kiosks and plant to existing PPP platforms in the state. CHAI will leverage the BMGF respiratory care grant to continue to provide support for the sites
CHAI	**BMGF - GLOBAL RESPIRATORY SUPPORT GRANT (AVENGERS I)**	1). Training of BMEs in three states (2). Planning to roll out trainings to 150 HCWs per state (~500) 3). Facility assessments in 16 states 4). Supplier mapping and engagement 5). Rapid assessment of PSA plants in Nigeria 6.) Creation of oxygen coordinating systems at the sub-national level 7). Supporting oxygen weeks and technical support for the roll out of oxygen repair drives in Kano state	1). 97 BMES have been trained using a standard training curriculum. 2). Ongoing work in finalizing HCW training modules
CHAI	**UNITAID**	1). Trained a cohort of BME Master trainers two per state across 36 states 2). Procurement of 6 200Kva generators across 6 THFs in the country 3). Procurement of oxygen delivery equipment 4). Procurement of ~1200 cylinders 5). and technical support for the roll out of oxygen repair drives in Kano state	

UNICEF	**UNICEF**	1). Delivered 120 Concentrators to the NCDC 2). 1,064 Concentrators donated to THFs, to deliver additional 800 concentrators to SHFs 3). Training of HCWs on rational use of oxygen and pulse oximetry 4). Launching an oxygen security system in 10 states, started piloting in 3 states (Successful launch in Oyo and Kano state) 5). Procurement of Nine (9) skid mounted PSA plants to be distributed 4 300LPM and 2 600LPM) PSA plant 6). Planning for training for BMEs and HCWs	Concentrators procured were 5L concentrators and therefore limited capacity to manage CV-19 hypoxaemia due to lower flow rates
Save the Children (INSPIRING PROJECT)	**GSK**	**Pneumonia INSPIRING PROJECT** 1). Partnered with OLI in training HCW on pulse oximetry and oxygen therapy 2). Repaired 18 broken down oxygen concentrators and taken delivery of 44 pulse oximeters for one secondary health facility in Jigawa state. 3). Trained HCWs and CHWs on the use of oxygen and pulse oximetry 4). Launched an oxygen desk in Jigawa	STC is also working in Lagos state to coordinate oxygen systems and supporting increasing supply (concentrators, piping in Ikorodu LGA)
WHO	**WHO**	1). Supportive supervision in ITCs 2). Rapid assessment of oxygen supply in ITCs across states in the Nigeria in July 2021 – 3)***. 545 Concentrators donated to PTF*** 4). Procurement of 26 ventilators	
FHI – 360: Meeting Targets and Maintaining Epidemic Control (EpiC)	**USAID**	**Strengthen Ventilatory capacity for COVID - 19 response.** 1). Assessment of 88 ITCs to assess readiness to provide ventilatory support and critical care 2). Procurement of Ventilators (~200 for 88 facilities) 3). Training of 995 HCWs on Covid Case Management using virtual 8-hour training modules **4).** Registered ~120 participants on virtual SCCM course 5). Training of BMEs on maintenance of ventilators specific to brand	Focus is on critical care management and ventilatory support. Will need to collaborate closely with other partners providing oxygen supply to complement their ongoing work
FHI-360	**USAID**	**Oxygen Technical Assistance** **1)** Strengthening National Level coordination for medical oxygen **2)** Strengthening a community of practice for medical oxygen **3)** Strengthening health worker capacity for management of hypoxaemia and oxygen delivery systems **4)** Development of health facility oxygen system plans **5)** Development of medical oxygen equipment tracking system	

FHI-360	**USAID**	**Liquid Medical Oxygen (LOX) Infrastructure** **1)** Support of infrastructural expansion for improved medical oxygen access **2)** Capacity strengthening for health workers including BMEs	This focuses on expansion of liquid medical oxygen access to health facility through infrastructural upgrade, capacity building and sustainable financing mechanisms.
WORLD BANK	**WORLD BANK**	**COVID-19 Oxygen Support:** *Financing available for surge preparedness through REDSSE/COPREP to procure 10L Oxygen concentrators and other necessary accessories.*	*Procurement through NCDC - REDISSE PCU.*
CHAI	**UNITAID ACT-A**	**COVID-19 Oxygen Support (14 states):** 1. Procurement and distribution of 1142 cylinders 2. Procurement and distribution of 836 pulse oximeters 3). Oxygen generators for ~6 FMoH PSA Plants 4). Venturi masks, nasal cannulas 5). Training of 380 BMEs 6). Training of ~760 HCWs	
CHAI	**UNITAID**	1). National need gap 2). Regulatory pathway mapping 3). Supplier engagement for LOX 4). National and sub-national road map development 5). Capacity building: mentoring and supportive supervision 6) Support for implementing bulk liquid expansion	
Life Bank	**Oxygen Hub**	**PSA Plant Franchising Models** 1). Rolled out a PSA plant in Orozo LGA in Nasarawa state on 13th July 2021 (700m3- a day PSA plant	
NACA	**GLOBAL FUND**	**Repair and refurbishment of PSA plants** 1. Technical appraisal of existing plants in Nigeria 2. Planning for repair and refurbishment of plants that are non-functioning	
NACA	**GLOBAL FUND C19-RM (fast-track)**	**Oxygen procurements to meet gaps in 14 states (SHFs/THFs)** 1). ~15k cylinders (likely that this number will be reduced) 2). 4,900 pulse oximeters 3). 2,086 10L Concentrators 4). Delivery interfaces: HFNCs, Cannulas; BiPAP/CIPAP/Venturi masks 5). Liquid oxygen tanks and filling ramps/manifolds 6). Oxygen piping expansion to 440 wards (4,400 beds)	
NACA	**GLOBAL FUND C19-RM (main application)**	**Oxygen procurements to meet remaining gap in country+ Capacity Building** 1). HCW trainings - 50 per state drawn from THF/SHFs	

		2). Additional procurements of oxygen equipment	
GSK	**Save the Children**	Procurement of 80 oxygen cylinders; 16 pulse oximeters; 8 oxygen concentrators; 4 oxygen analysers Piped oxygen systems in 4 facilities in Jigawa state: 26 oxygen outlets in the paediatric ward, ICU, and Accident and Emergency Unit (A&E) at Hadejia, 12 oxygen outlets in the paediatric ward at Gumel, 34 oxygen outlets in the paediatric ward and A&E at Babura, and 20 oxygen outlets in the paediatric ward at Kazaure.	

I: Facilities with LOX capacity in-country

State	Facility
Plateau	University of Jos Teaching Hospital
FCT	National Hospital Abuja

J: Health Facilities with a Pressure Swing Adsorption (PSA) Plant

SN	State	Facility	Level of Health Facility
1	Adamawa	Federal Medical Centre Yola	Tertiary
2	Katsina	Federal Medical Centre Kastina	Tertiary
3	Katsina	General Hospital Daura	Secondary
4	FCT	Federal Medical Centre Jabi	Tertiary
5	FCT	University of Abuja Teaching Hospital	Tertiary
6	FCT	National Hospital Abuja	Tertiary
7	FCT	General Hospital Maitama	Secondary
8	Oyo	University College Hospital Ibadan	Tertiary
9	Osun	Obafemi Awolowo University Teaching Hospital Ife	Tertiary
10	Ondo	Federal Medical Centre Owo	Tertiary
11	Ogun	Federal Medical Centre Abeokuta	Tertiary
12	Lagos	Lagos University Teaching Hospital	Tertiary
13	Lagos	Federal Medical Centre Ebute Metta	Tertiary
14	Lagos	National Orthopaedic Hospital Igbobi	Tertiary
15	Ekiti	Federal Teaching Hospital Ido Ekiti	Tertiary
16	Edo	University of Benin Teaching Hospital	Tertiary
17	Edo	Irrua Specialist Teaching Hospital	Tertiary
18	Cross River	University of Calabar Teaching Hospital	Tertiary

19	Delta	Federal Medical Centre Asaba	Tertiary
20	Bayelsa	Federal Medical Centre Yenagoa	Tertiary
21	Akwa Ibom	University of Uyo Teaching Hospital	Tertiary
22	Imo	Federal Medical Centre Owerri	Tertiary
23	Enugu	University of Nigeria Teaching Hospital Enugu	Tertiary
24	Abia	Federal Medical Centre Umuahia	Tertiary
25	Plateau	Jos University Teaching Hospital Jos	Tertiary
26	Niger	Federal Medical Centre Bida	Tertiary
27	Kwara	University of Ilorin Teaching Hospital Ilorin	Tertiary
28	Kogi	Federal Medical Centre Lokoja	Tertiary
29	Benue	Federal Medical Centre Makurdi	Tertiary
30	Zamfara	Federal Medical Centre Gusau	Tertiary
31	Sokoto	Usman Danfodio University Teaching Hospital, Sokoto	Tertiary
32	Kebbi	Federal Medical Centre Birnin Kebbi	Tertiary
33	Kano	National Orthopaedic Hospital Dala	Tertiary
34	Kano	Aminu Kano Teaching Hospital Kano	Tertiary
35	Kaduna	Ahmadu Bello University Teaching Hospital Zaria	Tertiary
36	Kaduna	General Hospital Kafanchan	Secondary
37	Jigawa	Federal Medical Centre Jigawa	Tertiary
38	Yobe	Federal Medical Centre Nguru	Tertiary
39	Yobe	General Hospital Potiskum	Secondary
40	Borno	University of Maiduguri Teaching Hospital	Tertiary
41	Taraba	Federal Medical Centre Jalingo	Tertiary
42	Gombe	Federal Teaching Hospital Gombe	Tertiary
43	Bauchi	Abubakar Tafawa Belewa University Teaching Hospital	Tertiary
44	Bauchi	Federal Medical Centre Azare	Tertiary
45	Adamawa	General Hospital Hong	Secondary

K: List of Contributors

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