



REPUBLIC OF KENYA

Ministry of Health

KENYA MEDICAL OXYGEN ROADMAP

2025-2030





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ACRONYMS

AMEK	Association of Medical Engineering of Kenya
CECM	County Executive Committee Member
CHERP	Covid 19 Health Response Project
CHMT	County Health Management Team
COG	Council of Governors
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus Disease 2019
CPAP	Continuous Positive Airway Pressure
CSOs	Civil Society Organizations
DHPT	Directorate of Health Products and Technologies
EML	Essential Medicines List
FIF	Facility Improvement Financing
GDP	Gross Domestic Product
HPT	Health Products and Technologies
HRH	Human Resources for Health
ICU	Intensive Care Unit
IMNCI	Integrated Management of Childhood Illness
KEBS	Kenya Bureau of Standards
KHFS	Kenya Health Financing Strategy
KHHEUS	Kenya Household Health Expenditure and Utilization Survey
KHIS	Kenya Health Information System
KMPDC	Kenya Medical Practitioners and Dentists Council
KMPDU	Kenya Medical Practitioners, Pharmacists and Dentists Union
KNH	Kenyatta National Hospital
KPA	Kenya Pharmaceutical Association
KUTRRH	Kenyatta University Teaching, Referral and Research Hospital
LMIC	Low- and Middle-Income Countries
LOX	Liquid Oxygen
MCH	Maternal and Child Health
METU	Medical Engineering and Technologies Unit
MOH	Ministry of Health
MTRH	Moi Teaching and Referral Hospital
NCK	Nursing Council of Kenya
NHA	National Health Accounts
NHIF	National Health Insurance Fund
NICU	Neonatal Intensive Care Unit
NSA	Non State Actors
OOP	Out of Pocket
OPD	Outpatient Department
PHC	Primary Health Care

PMS

PPB

PPP

PSA

PSK

SHA

SHIF

SOP

UHC

URTI

VIE

VSA

WHO

Post Marketing Surveillance

Pharmacy and Poisons Board

Public Private Partnerships

Pressure Swing Adsorption

Pharmaceutical Society of Kenya

Social Health Authority

Social Health Insurance Fund

Standard Operating Procedures

Universal Health Coverage

Upper Respiratory Tract Infection

Vacuum Insulated Evaporator

Vacuum Swing Adsorption

World Health Organization

FOREWORD

Medical Oxygen is an essential lifesaving health commodity. It has no substitute when used in the management of health conditions requiring it including pneumonia and COVID-19, as well as others requiring breathing support. It is essential for medical, surgical and obstetric emergencies, as well as for newborns in respiratory distress.

Availability of quality medical oxygen is often a challenge in many low and middle-income countries (LMIC) with the most deleterious effects on primary care health facilities serving impoverished, rural, and marginalized populations. Less than 50 percent of health facilities have uninterrupted access to it. Of the 7.2 million children with pneumonia in critical need of medical oxygen each year in LMICs, only one in five children will receive it. The increased demand for medical oxygen due to COVID-19 exacerbated these chronic shortages.

In Kenya, predisposing conditions for hypoxemia are widespread with upper respiratory tract infections (URTI) being the leading cause of morbidity in both children and adults over the past five years (2018–2023). Pneumonia and other diseases of the respiratory tract have also ranked high among the reasons for outpatient visits during this period.

The Ministry of Health has taken proactive measures to address the availability of quality medical oxygen through investments in generation, storage (including bulk liquid oxygen) and distribution through piping in health facilities. This is in line with the Government's commitment and determination to realize the constitutional right to health in the shortest time possible by delivering Universal Health Coverage (UHC), through provision of quality essential health products and technologies (including medical Oxygen). Further efforts are directed at expanding local manufacturing. All this has been achieved through coordinating efforts of different stakeholders, including partners, donors, and the private sector.

This Roadmap provides direction and guidance for Kenya's health sector in regard to medical oxygen. It builds on existing efforts to optimize the available resources in the public and private sectors and guide future investments from Government, partners, and private-sector actors to bridge existing gaps as well as ensure sustainability. To this end the Roadmap highlights nine strategic intervention areas as follows; (1) Governance, management and coordination; (2) Regulation, guidelines and policies; (3) Systems for Oxygen production, storage, transport, distribution and delivery; (4) Infrastructure; (5) Respiratory medical devices and inventory; (6) Human resources for health; (7) Monitoring, evaluation and research; (8) Finance for medical Oxygen; (9) Service delivery and quality assurance.

In order to achieve the objectives of this Roadmap, we call for concerted efforts by all stakeholders in the mobilization of the required resources to support implementation in a coordinated manner at both the national and county levels. This will go a long way in improving access to quality medical oxygen.



Dr. Patrick Amoth, EBS
Director General for Health

EXECUTIVE SUMMARY

In May 2023, the World Health Organization Executive Board recommended the adoption of a resolution to increase access to medical oxygen at the 76th World Health Assembly (WHA). The resolution recognizes medical oxygen as an essential medicine and emphasizes its critical role in achieving health-related sustainable development goals, including reducing maternal and child mortality and accelerating progress towards universal health coverage. The resolution also recognizes the importance of medical oxygen in treating hypoxemia across various conditions, including COVID-19, pneumonia, tuberculosis, situations requiring surgery, emergency, and critical care.

Over the past few years, the Ministry of Health and its development partners have mobilized resources to enhance the production, storage, and delivery of medical oxygen to health facilities across Kenya. Although the country still faces challenges with the availability of this essential drug, significant progress has been made compared to the pre-pandemic period.

There is a need to put in place plans to safeguard investments made to enhance the medical oxygen systems in Kenya. There is need to align with the 76th WHA resolution that urges member states to develop costed national plans to increase access to quality assured, affordable medical oxygen systems. This Roadmap is a demonstration of the Ministry's commitment to leverage the existing investments to create a resilient health system.

The Kenya Medical Oxygen Roadmap 2025-2030 is anchored on an ambitious overall goal whose realization is envisaged through nine strategic objectives. The **overall goal** is to ensure all Kenyans have access to quality, sustainable and affordable medical oxygen by the year 2030, as envisaged in the Kenya Health Policy 2014-2030.

The strategic objectives are broken down into strategic interventions that are not only aligned with the WHA resolution but also tailored to the current situation in the Kenyan landscape. Therefore, pursuing any of the interventions will contribute to the strategic objective and in turn, solve an existing challenge in our society today.

The Roadmap is organized into six chapters.

Chapter 1 provides the rationale for the Roadmap. The chapter provides a brief introduction and describes the development process behind this Roadmap. A key highlight in this chapter is the recognition and hence adoption of established guiding policies such as the Quality Management System (QMS) of the Ministry of Health that guides on how to conduct comprehensive and consultative processes in strategic setting. There WHO Oxygen Roadmap Template Zero-Draft, published in May 2024, is also recognized as a key document influencing the structure of this Roadmap.

Chapter 2 provides an assessment of the situation in Kenya as of the year 2024. Evidence is presented on the Kenyan health system as is relevant to medical oxygen. The Roadmap estimates the demand, supply and hence the gap for medical oxygen. The chapter also presents the status on financing for medical oxygen, the current oxygen related training gaps for health workers and maintenance staff and the status of reporting for medical oxygen in the Kenya Health

Information System (KHIS). An assessment of Kenya's medical oxygen landscape is provided and priorities recommended from this.

The key highlight from this chapter is the quantification of medical oxygen needs and production capacities. The country needs 62 to 64 billion litres of medical oxygen every year. The current production capacity stands at 12 billion litres. The current production capacity can meet only 19% of the estimated medical oxygen needs in Kenya. This significant gap underscores the urgent need for the Roadmap.

Chapter 3 builds on the assessment in the previous chapter to articulate the strategic goals and interventions that will be pursued over the life of the Roadmap. A key highlight from this chapter is the articulation of an overall goal, the strategic objectives and the strategic interventions.

Chapter 4 presents the arrangements in place to proper management and implementation of the strategic interventions. This chapter describes the roles and responsibilities of the National Government, the County governments, and the partners. A significant advancement in this document is the establishment of coordinating mechanisms among various stakeholders and partners in Chapter 4. This mechanism will significantly enhance the utilization of limited resources available in the country. The Roadmap proposes coordination efforts to be initiated by the Ministry of Health and to span across different stakeholders.

Chapter 5 presents a snapshot of the budget and the resource mobilization considerations to ensure sustainability of this Roadmap. The key highlight is that the implementation of this Roadmap will cost KES 37 billion. Over 80% (KES 32 billion) of this cost will be earmarked for capital investments necessary to build infrastructure on medical oxygen systems. Resource mobilization considerations made include increasing government funding, optimizing the use of existing resources, and fostering new partnerships with the private sector.

Chapter 6 is the last chapter on monitoring and evaluation plans against which the implementation of this Roadmap will be appraised. A key highlight in this chapter is the presentation of overall impact targets and indicators. A detailed account of the activity-based output indicators is Annexed to this Roadmap.

Overall, while Kenya has made notable progress in enhancing access to medical oxygen in recent years, significant deficiencies persist. Many of these facilities still lack adequate medical oxygen and associated devices, which are critical for patient care. This current situation underscores the urgent necessity for a comprehensive strategic plan to ensure the consistent availability and delivery of affordable medical oxygen across all levels of the healthcare system.



Dr. Tom Menge

Directorate of Health Products and Technologies

Ministry of Health

ACKNOWLEDGEMENTS

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We acknowledge the invaluable input of all technical experts, drawn from the Ministry of Health, partners and Counties, who went out of their way to research, collate and compile the content for this document. We appreciate PATH and BMGF for the technical and financial support in the development process of this Roadmap. Finally, we thank all those who participated and whose diverse contributions made it a success.

CHAPTER 1: INTRODUCTION

1.1 KENYAN CONTEXT

The Republic of Kenya, covering about 580,367 square kilometres, is in East Africa. It borders South Sudan to the northwest, Ethiopia to the north, Somalia to the east, Uganda to the west, Tanzania to the south, and the Indian Ocean to the southeast. According to the 2019 National Census report, Kenya's current population is estimated to be 55.3 million, with an average household size of 3.8 people. Approximately 70 percent of this population resides in the rural areas. The average life expectancy at birth is 62 years. Kenya, classified as a lower-middle-income country, relies on its robust agricultural sector, with tea and coffee serving as the primary cash crops. Additionally, tourism plays a significant role as one of the major economic drivers. The 2024 Kenya National Bureau of Statistics economic report (KNBS, 2024) highlights that the country's gross domestic product (GDP) growth rate has remained stable over the past three years, fluctuating between 4.8 percent and 7.6 percent.

According to the Constitution of Kenya 2010, the country operates under two levels of governance: the National Government and County Governments. Health is a devolved function, with the National Government tasked with developing policies, guidelines, standards, and providing capacity building and technical assistance to the County Governments. Article 43(1) of the Constitution enshrines the right to the highest attainable standard of health for all citizens. The decentralization of healthcare services to the 47 County Governments has mandated them to allocate financial resources and support healthcare service delivery, albeit with varying levels of commitment.

Kenya has a strategic development plan that is outlined in Vision 2030. This initiative aims to transform Kenya into a globally competitive and industrialized nation, ensuring citizens enjoy high-quality life within a clean and secure environment by 2030. Health constitutes one of the social pillars and serves as a crucial component of this blueprint. Similarly, the Kenya Health Policy 2014-2030 aligns with the Vision 2030, and intends to implement various strategies to guarantee the availability of quality healthcare services and medical supplies, including medical oxygen, to enhance quality health service delivery by 2030. Furthermore, Vision 2030 development plan aligns with overarching global policies, such as the Sustainable Development Goals for health, which aim to reduce maternal mortality (target 3.1), decrease newborn and child mortality (target 3.2), lower premature mortality resulting from chronic conditions (target 3.4), and attain universal health coverage (UHC) by 2030.

Equitable access to essential health products is key to achieving UHC. Medical oxygen was recognized as an essential medicine in the 76th World Health Assembly (WHA) resolution. Following this resolution, the World Health Organization (WHO) included medical oxygen in the Essential Medicines List (EML) 2023. Kenya also included it in the Kenya's Essential Medicines List (KEML) 2023.

In this regard, the Government of Kenya continues to invest in systems to strengthen equitable access to medical oxygen in the country for both routine healthcare delivery and for emergent situations. A Roadmap for a medical oxygen ecosystem integrated within Kenya's healthcare

system structure will enhance medical oxygen availability, streamline distribution, and support effective treatment at all levels of care.

1.2 RATIONALE FOR THE MEDICAL OXYGEN ROADMAP

In recent years, the Ministry of Health (MOH) and development partners have mobilized investments totaling over USD 60 million to improve the production, storage, and delivery of medical oxygen in health facilities. This significant investment has markedly increased access to medical oxygen, with nearly all health facilities equipped with critical care departments now having access to this vital resource.

However, independent assessments have highlighted several challenges. In some health facilities, the quality of generated medical oxygen was found to be substandard and unsuitable for managing medical emergencies requiring oxygen therapy (MOH, 2023). Additionally, even where medical oxygen was available, the infrastructure for its distribution and delivery to user points was often inadequate. Furthermore, planned preventive maintenance practices were either sub-optimal or entirely absent in some facilities (Muita, 2016).

The development of a comprehensive Roadmap is essential to safeguard these substantial investments. This Roadmap will ensure the sustainability of these investments by advocating for County Governments to allocate budgets for operational costs and preventive maintenance activities. Moreover, it will identify existing gaps and outline strategies to address them.

This Roadmap aims to examine all stages of the medical oxygen value chain, from production and storage to distribution and administration. It seeks to identify and recommend strategic interventions that will create an enabling environment for stakeholders in the medical oxygen sector. Ultimately, this will contribute to ensuring that Kenyans have access to their fundamental right to the highest attainable standards of health.

This Roadmap contributes to the endeavours and vision articulated in the ongoing health sector policies and strategies, specifically:

- I. **Kenya Health Policy 2014 - 2030:** Its goal is to attain the highest possible standard of health in a responsive manner. Within this policy, ensuring the availability and accessibility of essential medical supplies, such as medical oxygen, is crucial to achieving these health standards.
- II. **The Health Products and Technologies (HPT) Supply Chain Strategy 2020–2025:** It plays a pivotal role in streamlining the supply of the country's health products supply and technologies, including medical oxygen, by ensuring the availability, accessibility, and efficient delivery of these health products across all healthcare facilities.
- III. **PHC strategic framework:** Its goal is to reduce the burden of health needs through universal access to comprehensive health services. Ensuring the availability of essential medicines, including medical oxygen, is crucial to attaining this comprehensive care, as it plays a vital role in managing various health conditions and emergencies.

- IV. **Kenya UHC Policy 2020 – 2030:** Its goal is to ensure all Kenyans have access to essential quality health services without suffering financial hardship. Medical oxygen is an essential life-saving medicine that cuts across various healthcare services.
- V. **Kenya Community Health Strategy 2020-2025:** It advocates for home-based care for patients with chronic health conditions and those on palliative care, as well as home-based isolation for infectious diseases. Ensuring the availability of medical oxygen at the community level is helpful to support these initiatives, particularly for patients with respiratory conditions who require oxygen therapy.

1.3 ROADMAP DEVELOPMENT PROCESS

The development of the Kenya Medical Oxygen Roadmap (2025-2030) was done through a comprehensive and consultative process conducted as per the standard procedures outlined in the Quality Management System (QMS) of the Ministry of Health.

A technical team led by the MOH – Directorate of Health Products and Technologies (DHPT) was established. This team had representations from County Governments (specifically from Nyeri, Isiolo, Makueni, Kiambu and Busia). The private sector, including healthcare providers, professional associations and developmental partners, were also represented in the technical team (list of contributors is in the annex).

The Roadmap outline was developed using the WHO Oxygen Roadmap Template Zero-Draft, published in May 2024.¹ The team convened to assess the current state of the medical oxygen value chain. Through several presentations and plenary discussions, thematic areas were identified, forming the foundation of the Roadmap. Subsequently, a vision was articulated, followed by the strategic objectives and necessary interventions to achieve this vision. A lean drafting team was then formed to refine the document into a working draft, which subsequently underwent external reviews and validation. The validated document was submitted to the leadership at MOH for approval and adoption. The drafting of the document was started in August, 2024 and approved in March 2025.

¹ **National Oxygen Scale-Up Framework Meeting: Road to Oxygen Access** in Dakar, which developed a template for developing evidence-based, inclusive and costed national plans for oxygen scale up.

CHAPTER 2: SITUATIONAL ANALYSIS

2.1 HEALTH STATUS IN KENYA

Kenya has achieved notable progress in improving health outcomes through the diligent application of its health sector policies and strategies. Despite these advances, respiratory infections and tuberculosis remain the primary causes of morbidity and mortality in the country. According to the Institute of Health Metrics and Evaluation, in 2021, the leading cause of mortality in Kenya was respiratory infections and tuberculosis. This group of disease accounted for 208 deaths per 100,000 people, a 70 percent rise from a decade earlier, where it accounted for 122 deaths per 100,000 people (IHME, 2021). Data from the Kenya Health Information System (KHIS) shows that since 2018/19, upper respiratory tract infections (URTI) have been the leading cause of outpatient visits and hence morbidity, in Kenya. They are particularly prevalent among children under 5 years old, accounting for an average of 32.6 percent of morbidities in this age group. For individuals over 5 years old, URTI remains the most common condition, representing an average of 19.8 percent of morbidities from 2018/19 to 2022/23 (Table 1).

Table 1: Proportion (%) of URTI as the cause of morbidity in Kenya across the years

Year ending:	2019	2020	2021	2022	2023	Average
Under 5 years	29	30	34	38.4	31.7	32.6
Over 5 years	19	18	21	21.6	19.5	19.8

Source: KHIS, 2023

Pneumonia had a significant impact, particularly on children under five years of age. Between 2019 and 2023, it consistently ranked as a leading cause of outpatient visits, peaking in 2021. Similar to upper respiratory tract infections (URTI), the burden was most pronounced among children under five (Table 2).

Table 2: Proportion (%) of Pneumonia as the cause of morbidity in Kenya across the years

Year ending:	2019	2020	2021	2022	2023	Average
Under 5 years	3.2	3.5	6.4	4	3.5	4.1
Over 5 years	2	2	2.8	2.2	2.1	2.2

Source: KHIS, 2023

The burden of other respiratory diseases has shown a relatively stable trend, particularly among children under 5 years, with an average burden of about 6 percent between 2019 and 2023. In contrast, pneumonia within the same age group experienced a sharp increase in cases between 2020 and 2021, nearly doubling. Conversely, there has been a decreasing trend in the burden of both pneumonia and other respiratory diseases among individuals over 5 years old. By 2022, other respiratory diseases ceased to be among the top 10 causes of morbidity among children under 5 (Table 3).

Table 3: Proportion (%) of other respiratory diseases as the cause of morbidity in Kenya across the years

Year ending:	2019	2020	2021	2022	2023	Average
Under 5 years	6.1	5.9	6.7	n.d.	n.d.	6.2
Over 5 years	4.5	3.9	3.8	2.8	3.1	3.6

Source: KHIS, 2023

HYPOXEMIA IN KENYA

URTI and other respiratory infections can lead to hypoxemia by causing inflammation and congestion in the airways, which restricts airflow, consequently reducing oxygen levels in the blood.

Hypoxemia, a condition characterized by low levels of oxygen in the blood, is a significant global health issue that contributes to one million deaths annually, with the majority being children under five. The burden of hypoxemia is estimated to be higher yet underreported in Sub-Saharan Africa (SSA) due to a lack of diagnostic capabilities such as pulse oximetry. These resource constraints contribute to late hypoxemia detection and preventable deaths (Rahman et al., 2022). Examples of hypoxaemic disease conditions include Lung conditions such as; pneumonia, bronchitis, emphysema, pulmonary edema, pulmonary fibrosis, pulmonary embolism, pneumothorax, heart condition like; congestive heart failure, heart failure, pulmonary hypertension, blood conditions such as anemia, blood clots and other conditions like asthma, sleep apnea, meningitis, severe sepsis, congenital heart defects.

A study conducted in Kenya between 2019 and 2022 among 4,104 adult patients admitted to the medical wards indicated that 24 percent (975) were hypoxemic on admission, while 1 in 11 patients experienced chronic hypoxemia (Navuluri, N., et al. 2023). A similar study conducted at Kenyatta National Hospital (KNH) between March 2020 and April 2021 found that COVID-19 patients with lower blood oxygen levels were significantly more likely to require referral to the intensive care unit (ICU).

The burden of hypoxaemic diseases in the country is particularly high among children, and evidence suggests the risk of death in hypoxemic children can be seven times higher than in other hospitalized children in certain resource-constrained settings. For instance, a study conducted in Kenya's coastal region between 2002- 2005 reported a prevalence of hypoxemia of 6.4 percent among children in Kilifi, which was strongly correlated with an inpatient mortality rate of 57 percent (Mwaniki et al., 2009). The most prevalent underlying conditions leading to inpatient mortality included neonatal sepsis (39 percent), birth asphyxia (30 percent), and prematurity (24 percent). In 2023, data from the Kenya Health Information System (KHIS) identified birth asphyxia (28.4 percent), prematurity (19.9 percent), and lower respiratory infections (15.1 percent) as the leading causes of mortality in children under five years old. Additionally, other respiratory diseases accounted for approximately 3.2 percent of all deaths. Compromised oxygen levels in early

childhood can result in long-term developmental impairments, highlighting the importance of early detection and intervention.

Beyond respiratory infections, medical oxygen is also crucial for the emergency management of various obstetric conditions around the time of labor and delivery, and it is necessary for 20 percent of hospitalized neonates. Additionally, medical oxygen is a vital component of safe surgical procedures, and the lack of access to safe surgery results in an estimated 16.9 million preventable deaths annually (Lancet Commission on Global Surgery, 2015).

Therefore, improving access to medical oxygen, developing diagnostic capabilities, and addressing the underlying causes of hypoxemia from viral and chronic diseases are just a few of the multimodal strategies needed to address these determinants.

2.2 PRODUCTION AND SUPPLY OF MEDICAL OXYGEN

Overview

The Guidelines on Production, Delivery, and Management of Medical Oxygen, 2023 in Kenya recognize various methods of obtaining concentrated medical oxygen. these are:

- I. **Cryogenic fractional distillation** method uses a freezing section to produce Liquid Oxygen (LOX).
- II. **Pressure Swing Adsorption (PSA)** method generates medical oxygen in its gaseous form. Oxygen concentrators, which produce low-volume oxygen, use PSA technology featuring a molecular sieve, with the oxygen concentration typically above 90 percent.
- III. **Vacuum Swing Adsorption (VSA)** method separates gases from a gaseous mixture at near ambient pressure. The process subsequently transitions to a vacuum state to regenerate the adsorbent material. Unlike other Pressure Swing Adsorption (PSA) techniques, VSA operates at near-ambient temperatures and pressures.
- IV. **Vacuum Pressure Swing Absorption (VPSA)** method combines pressure swing adsorption and vacuum swing adsorption to concentrate oxygen by varying pressure levels throughout the process.
- V. **Chemical process** is the reaction between hydrogen peroxide and water to generate oxygen. This method is not typically used for producing large volumes.

The status for each method is provided in Table 4.

Following the different generation methods, medical oxygen can be supplied to the patient, from three main sources: Air Separation Units (ASU), Pressure Swing Adsorption (PSA) and Oxygen concentrators (Figure 1).

Figure 1: Sources and pathways of medical oxygen from production to patients

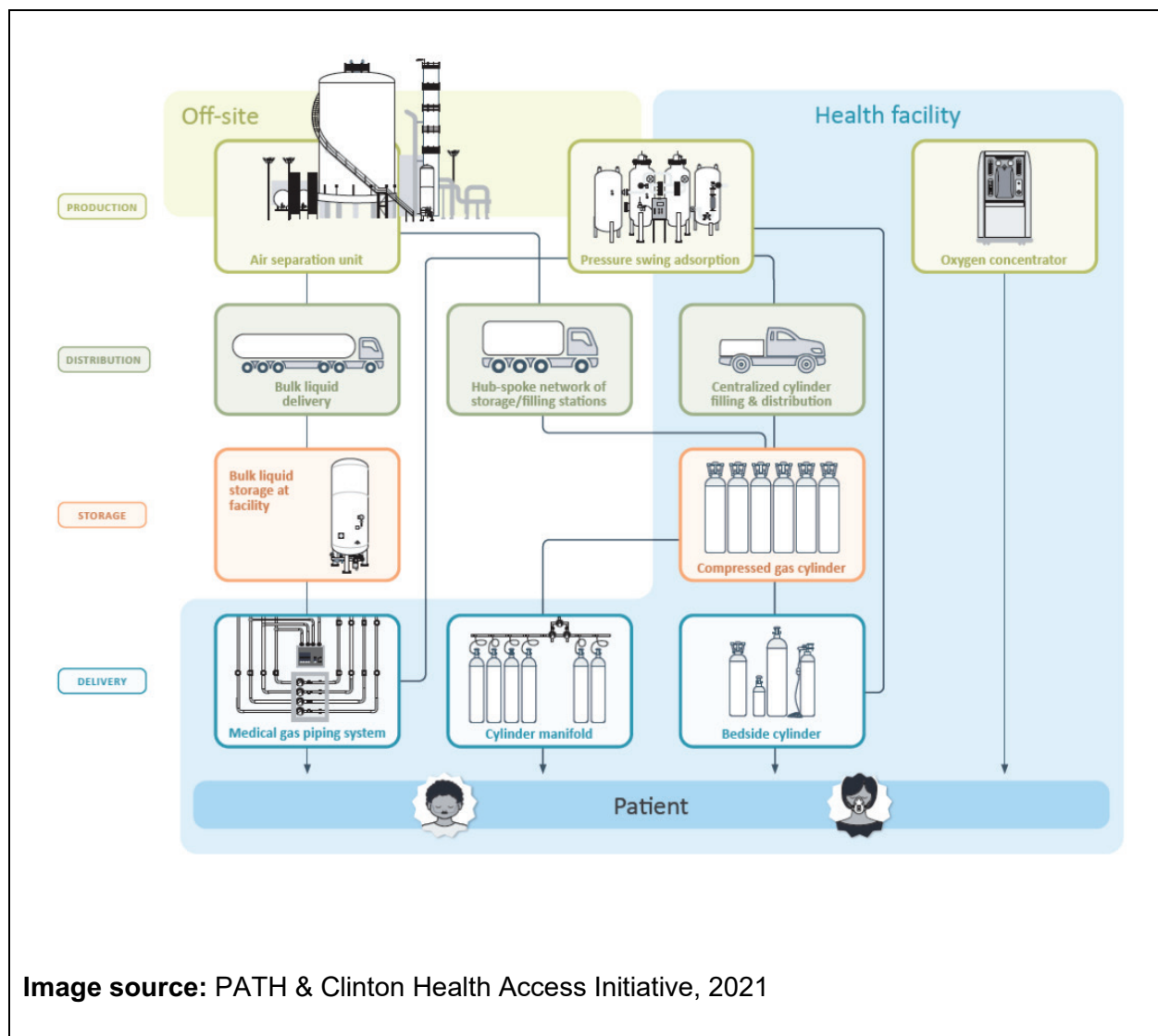


Table 4: Sources and pathways of medical oxygen from production to patients

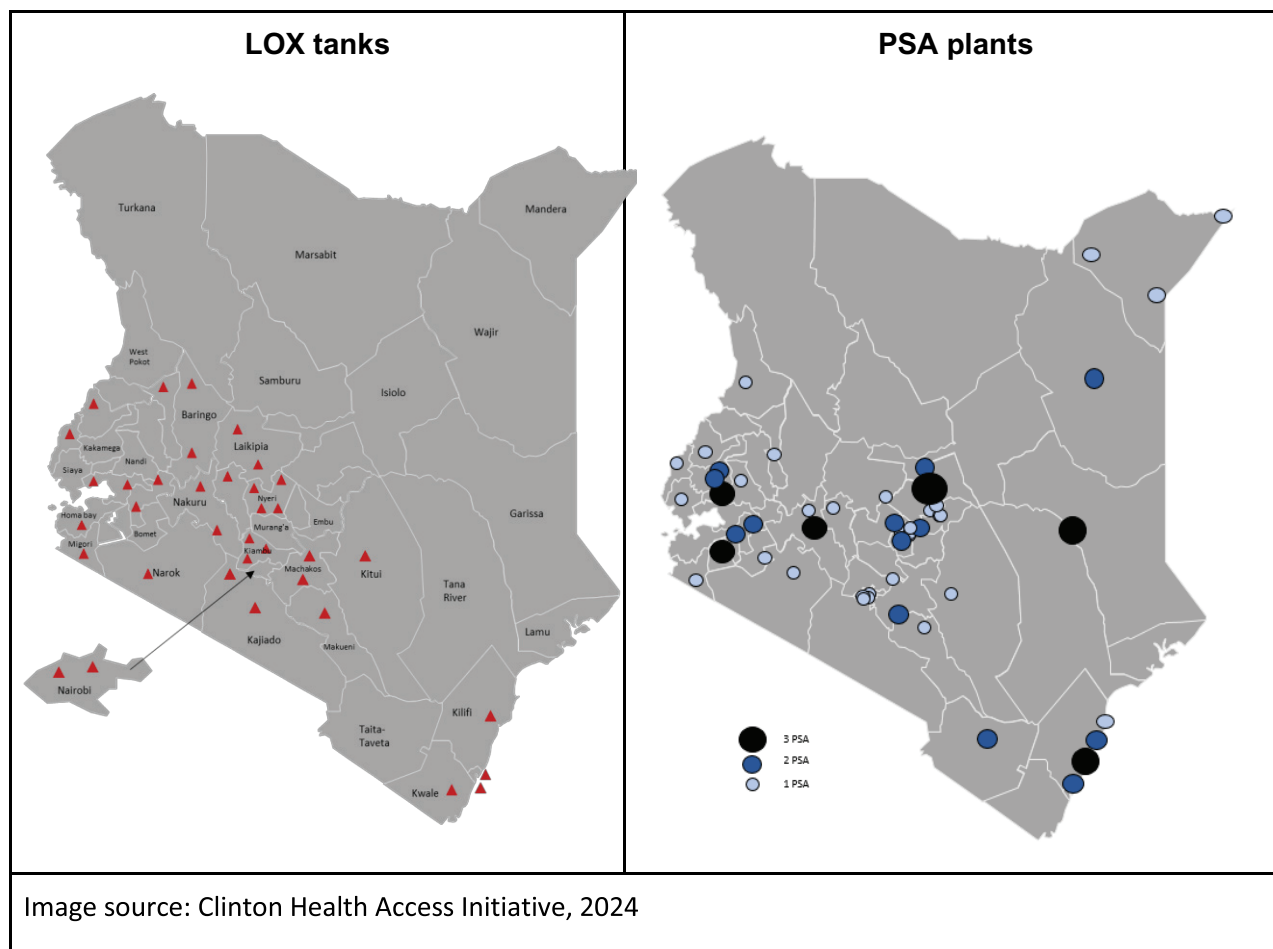
Source	Details	Current status in Kenya
Air Separation Unit (ASU)	Cryogenic technology is utilized to produce liquid oxygen (LOX) offsite. LOX is then transported and stored in special tanks called Vacuum Insulated Evaporators (VIE) which utilize vaporizer systems to convert the liquid oxygen into a gaseous form.	There is one dominant supplier in the market with a production capacity of 14 tons per day. Two new suppliers are installing plants which will have a combined capacity of 46 tons per day.
Pressure Swing Adsorption (PSA) and Vacuum Swing Adsorption (VSA)	These are large oxygen concentrators that produce gaseous oxygen and can serve an entire health facility and/or surrounding health facilities	75 PSAs are installed, 59 are functional ² , and fewer than 50 percent undergo regular maintenance.
Oxygen concentrators	This equipment is situated at a patient's bedside and generates oxygen through ambient air.	86 percent of public facilities (n=511) have concentrators in their inventory, with approximately 80 percent functionality. However, less than 65 percent have performed maintenance, and fewer than 40 percent have replaced filters.

Status of infrastructure for production and supply of medical oxygen

As outlined in Table 4 above, Kenya has 75 PSA plants with a total capacity of 40,000 liters per minute, 49 of which are operational, producing 3.03 billion liters annually (Figure 2). The Ministry of Health plans to add 27 more plants by 2025. The country also has a major private LOX producer and several importers, supplying bulk LOX to county hospitals. Additionally, commercial producers and health facilities refill medical oxygen cylinders for both their use and for sale to smaller, peripheral facilities.

² As at December 2024

Figure 2: Distribution of LOX tanks and PSA plants in Kenya



Challenges in the production and supply of medical oxygen

A significant barrier to reliable oxygen production and supply is the inadequate maintenance of PSA and LOX infrastructure. This shortfall stems primarily from the absence of a dedicated maintenance budget, cases of absence of local agents, insufficient skilled personnel to manage and operate the systems, and a lack of clear standard operating procedures (SOPs).

Further exacerbating the situation is the difficulty of acquiring critical service kits and spare parts, leading to prolonged downtime and inconsistent oxygen availability. Addressing these issues—by establishing a dedicated budget line, strengthening the workforce, standardizing SOPs, and ensuring a steady supply of essential service components—will be essential to creating a robust and efficient oxygen production and delivery system.

Another challenge in the supply chain is in the transportation of medical oxygen to the point of use; specifically, the: (a) mode of transport to and out of the health facility and (b) distance. The current supply chain is inefficient as facilities must travel long distances to collect or refill cylinders. The distances travelled and fuel costs lead to increased cost of access. Additionally, bulk

transportation at times is not compliant with relevant standards and guidelines. There are plans by the new LOX suppliers to set up 4 to 6 distribution and refilling centres across the country to reduce delivery time and cost.

2.3 AVAILABILITY OF MEDICAL OXYGEN IN THE HEALTH FACILITIES

The Ministry of Health (MOH) is the government body whose key mandate is to build a progressive, responsive and sustainable healthcare system for accelerated attainment of the highest standard of health to all Kenyans as enshrined in the Constitution of Kenya 2010. It is committed to delivering equitable, accessible, and sustainable healthcare to all citizens. Health care is delivered through a decentralized model, with national and county governments sharing responsibilities for various levels of health services.

At the national level, the MOH sets the standards, policies, and regulations that guide the entire healthcare framework. The MOH also supports counties technically and oversees key national facilities which provide advanced, specialised care. Within the Ministry, various departments—such as Public Health, Health Policy, and Health Products and Technologies—focus on specific healthcare needs and initiatives, ensuring comprehensive coverage of health priorities.

At the county level, Kenya's 47 counties manage local healthcare services through County Health Departments, which are responsible for primary and secondary care within their respective counties. Each county also has referral hospitals that serve as advanced facilities for specialised care, handling cases referred from smaller health facilities within the county.

The healthcare delivery structure is organised across six levels to address diverse health needs across the population:

Level 1: Community health services, is the first level of healthcare provision in Kenya that is constituted of: (i) Interventions focusing on building demand for existing health and related services, by improving community awareness and health seeking behaviours, and (ii) Taking defined interventions and services (as defined in the Kenya Health Sector Strategic and Investment Plan) closer to the community and households

Level 2: Dispensaries that offer basic outpatient services.

Level 3: Health centres that support maternal and child health, as well as outpatient care.

Level 4: Primary referral hospitals, catering to more advanced medical needs.

Level 5: Secondary referral hospitals, which provide specialised services to larger populations.

Level 6: Tertiary referral hospitals, the highest level of care, handling the most complex cases in the country.

A facility census conducted in 2023 revealed that Kenya had 12,375 health facilities (i.e. level 2 to level 6) distributed across its 47 counties. 71 percent (8,806) of these facilities were Level 2; 21 percent (2,559) were Level 3; 8 percent (971) were Level 4; 0.3 percent (34) were Level 5; and 0.004 percent (5) were Level 6 health facilities (Ministry of Health, 2023). The *Technical Specifications for Medical Oxygen Therapy Devices and Equipment*, 2024 recommends the availability of medical oxygen from Level 2.

Evolution of and trends in availability of medical oxygen

Prior to the COVID-19 pandemic, the availability of medical oxygen in health facilities was notably low. According to the Kenya Health Facility Assessment 2018-19, hospitals had the highest coverage at 72 percent, while dispensaries had the lowest at only 2 percent. On average, primary care facilities (comprising health centers and dispensaries) had a mean availability of 11 percent. Within hospitals, Neonatal Intensive Care Units (NICU) and Intensive Care Units (ICU) achieved full coverage at 100 percent, whereas general Outpatient Departments (OPD) and Maternal and Child Health (MCH) departments had the lowest coverage rates, at 8 percent and 2 percent respectively.

In 2023, the availability of medical oxygen had increased, with varying improvements across the tiers. Lower-level tiers, however, continued to exhibit the least availability of medical oxygen. For instance, only 20 percent of Level 2 facilities offering outpatient services reported possessing an oxygen cylinder and flowmeter or an oxygen concentrator. This availability increased with higher tiers: Level 3 facilities reported 58 percent, while Level 4 facilities reported 91 percent. Additionally, an assessment of medical oxygen availability revealed that 32 percent of facilities with OPD and 54 percent of facilities with MCH services were equipped with medical oxygen.

This data indicates that there is limited availability of medical oxygen at public facilities and lower-tier primary health service providers. This limitation may pose a risk to the attainment of UHC.

2.4 AVAILABILITY OF OXYGEN RELATED DEVICES AND ACCESSORIES

According to the Kenya Health Facility Assessment 2018-19, medical oxygen equipment was unavailable in 74 percent of the Level 2 facilities as opposed to only 15 percent in Level 4 facilities. The availability of three (bundled) tracer commodities which are critical for emergency breathing interventions i.e., Oxygen with tubing, flowmeter and humidifier was 56 percent for hospitals (n=387). Relative to ownership, 36 percent of private hospitals had all tracer commodities, followed by 14 percent of Faith-Based Organizations (FBO)/Non-Governmental Organization (NGO) hospitals and 11 percent of government facilities. Relative to geography, 26 percent of urban-based hospitals and 13 percent of rural-based hospitals had all these items.

Availability of nasal prongs for oxygen was just 43 percent. Nasal prongs for oxygen delivery, suction catheters and solusets were the least available medical supplies in the 2023 assessment. The Technical Specifications for Medical Oxygen Therapy Devices and Equipment, 2024 provides recommendations on the minimum requirements for each level of health facility. Lastly,

accessories are paramount to ensure that the quality of medical oxygen produced is of acceptable standards for patient use. Among the health facilities assessed, only 3 percent possessed oxygen analyzers to verify the purity of their medical oxygen. Additionally, 50 percent of the oxygen plants were equipped with inbuilt oxygen quality testing capabilities.

2.5 MEDICAL OXYGEN QUANTIFICATION AND GAP ANALYSIS

Quantification is a critical process in ensuring the availability of medical oxygen. It allows for development of accurate forecasts for medical oxygen demand, estimate financial requirements, and create supply plans that guide procurement and distribution. The results of quantification are essential for advocating resource mobilization at both National and County levels, optimizing the use of available resources, and coordinating with manufacturers to align production cycles and shipment schedules. Inaccurate quantification of medical oxygen can severely disrupt service delivery, either through resource wastage due to oversupply or undersupply ultimately leading to increased morbidity and mortality.

Successful quantification of medical oxygen requires thorough preparation, access to reliable data (such as facility-level oxygen consumption and patient load), and a team to lead the process and coordinate key stakeholders. This process involves forecasting oxygen demand, followed by supply planning to inform procurement and ensure a consistent and adequate supply across all healthcare facilities.

Challenges in quantification of medical oxygen in Kenya

Quantifying medical oxygen is faced with several challenges. Key issues include delayed adoption of reporting systems by counties and facilities due to funding challenges, incomplete reporting from health facilities, and limited technical expertise for forecasting and supply planning. Resource constraints, such as insufficient funding and infrastructure, further hinder accurate demand estimation and distribution.

Access disparities are made worse by supply chain inefficiencies, such as inadequate infrastructure and inefficient supply sources. Forecasting is made more difficult by a variety of healthcare requirements and non-standardized equipment, and planning initiatives are hampered by a lack of cooperation among stakeholders and little private sector involvement.

Investments in oxygen infrastructure are further constrained by a lack of funding and policy deficiencies. Accelerated adoption of the reporting systems, capacity building, and creative tactics like digital tools, public-private partnerships, and including oxygen planning into larger health plans are all needed to address these issues.

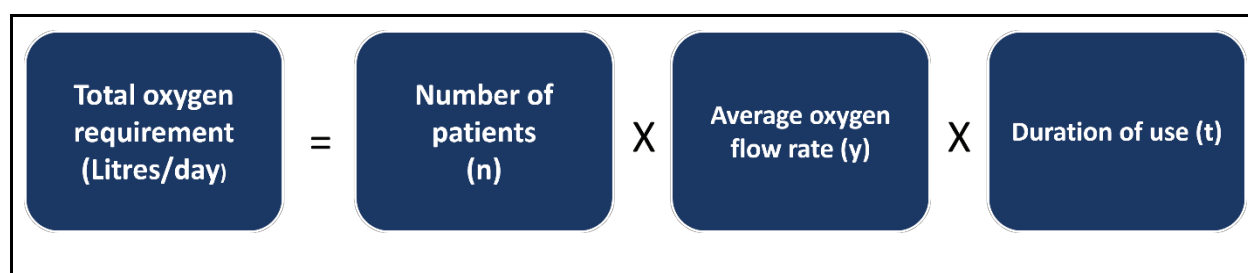
Quantification of demand for medical oxygen

This Roadmap considered two globally accepted approaches to estimate the demand size of the medical oxygen demand in Kenya. The two approaches are provided below.

I. Case based model: Estimating Medical Oxygen Need using Workload / Service statistics data

The case-based model is an adoption of the PATH *Quantification and Costing Tool: Oxygen Delivery Source* (PATH,2020). This is the estimating approach recommended in the *Guidelines on Production, Delivery and Maintenance of Medical Oxygen in Kenya, 2024*. Using data from the KHIS, clinical guidelines, and expert opinion, the case-based model applied the following formula to estimate the demand size of medical oxygen in Kenya:

Equation 1: Case based estimation approach



Adopted from the *Guidelines on Production, Delivery and Maintenance of Medical Oxygen in Kenya, 2024*

Where:

Number of patients (n): The estimated or actual number of patients needing oxygen therapy daily

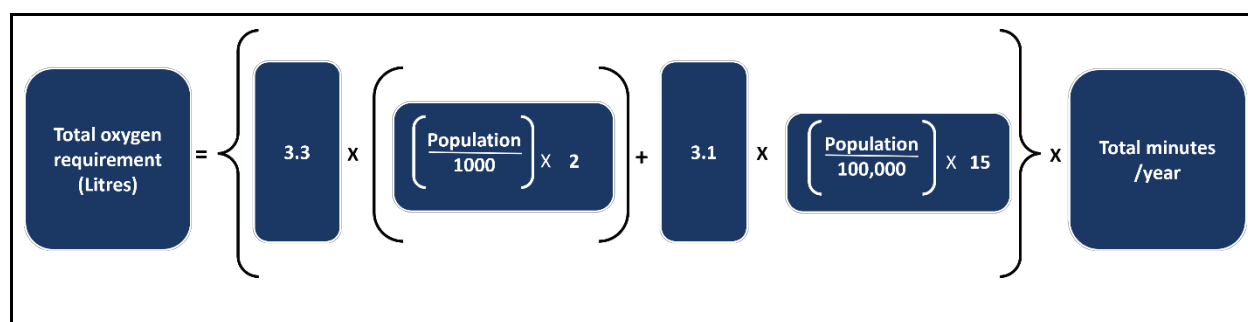
Oxygen flow rate (y): The average flow rate in liters per minute prescribed per patient

Duration of use (t): The average time per day (in minutes) each patient is expected to use oxygen.

II. Bed based model: Estimating Medical Oxygen Need using bed requirements

The bed-based approach is an adoption of the WHO - UNICEF oxygen estimation tool. Similar to the case-based model, the Roadmap leveraged data sourced from the KHIS, clinical guidelines, and expert opinion, to implement the equation below.

Equation 2: Bed based estimation approach



Assuming:

3.3 beds/1000 people for normal admission require oxygen therapy receiving an average of 2 litres per minute

3.3 beds/100,000 people for critical care require oxygen therapy receiving average 15 litres per minute

Additional considerations

A safety stock was included as a buffer stock to ensure availability of medical oxygen during supply disruptions or surges in demand. The safety factor depends on local conditions (e.g., 1.2 for 20 percent additional stock). Safety stock was computed as below:

Equation 3: Buffer stock estimation

The diagram illustrates the formula for buffer stock estimation. It consists of three dark blue rounded rectangular boxes arranged horizontally. The first box contains the text 'Safety stock (Litres)'. To its right is an equals sign (=). The second box contains the text 'Peak daily requirement (Litres/day)'. To its right is a multiplication sign (X). The third box contains the text 'Safety factor'.

$$\text{Safety stock (Litres)} = \text{Peak daily requirement (Litres/day)} \times \text{Safety factor}$$

Following the two approaches, and taking into consideration need for a safety stock, this Roadmap estimates the demand in Kenya to range between 62 and 64 billion litres per year. A detailed set of assumptions is provided in the Annex.

Estimation of the production size of medical oxygen

Considering the installed capacity, the following assumptions were made to estimate the total supply of medical oxygen in Kenya:

- I. For PSA, the estimate uses designed capacity however cognizance is given to the fact that they operate at a lower capacity.
- II. The model assumes the PSAs operate for on average 12 hours a day for 340 days.
- III. Admission and flow rates are estimated based on recommendations from existing guidelines
- IV. Case/workload summaries extracted from KHIS

As a result, the Roadmap estimates that at the end of 2024, the total production capacity in Kenya was ~12 billion litres per day.

Gap analysis for medical oxygen

Of the estimated production capacity in Kenya at ~12 billion litres, ~7 billion litres (58 percent) is estimated to come from LOX ASU plants and imported LOX whereas ~4.46 billion litres (42 percent) is estimated to come from PSA installed capacity at facility level. Relative to the demand

size of 62 to 64 billion litres per day, the production or available capacity can meet only 19 percent of the estimated medical oxygen needed in Kenya.

2.6 MONITORING AND REPORTING FOR MEDICAL OXYGEN

Medical oxygen indicators were integrated into KHIS for reporting, with two tools developed:

- I. MOH 753 - Oxygen Commodity Monthly Summary Tool (for logistics indicators)
- II. MOH 754 - Oxygen Service Delivery Monthly Summary Form (for service-level indicators)

However, reporting remains low, with MOH 754 at just 22 percent in the last quarter of 2024. These tools are being piloted in 26 counties, with plans to expand nationwide and improve reporting rates and data quality.

Meanwhile, the **Oxygen Management System (OMS)**, developed by MOH's Directorate of Health Products and Technologies in collaboration with USAID-RISE, is being piloted in 10 counties. OMS tracks real-time, patient-based oxygen consumption to improve demand estimation, planning, and resource allocation.

2.7 HUMAN RESOURCES FOR MEDICAL OXYGEN

Human resources for health in Kenya are crucial for delivering quality healthcare services across the country. The Kenya Health Facility Assessment, 2018 showed that the national density of core health personnel is approximately 5.6 per 10,000 population, which is below the WHO-recommended threshold of 23 per 10,000. It also showed that there were significant disparities in health workforce distribution, with only 6 out of 47 counties surpassing the WHO target. Rural and hard-to-reach areas face critical shortages of healthcare workers, impacting the quality of healthcare services.

As of December 2024, the country does not have a database to track the number of healthcare workers that have been trained in medical oxygen administration or the number of biomedical engineering professionals that have been trained in maintenance of medical oxygen equipment. However, it is noted that since the onset of the COVID-19 pandemic, some implementing partners supported on-the-job training on medical oxygen.

The Kenya Health Sector Strategic Plan (KHSSP) prioritises the health workforce as a key investment and aims to ensure adequate and equitable distribution of human resources. iHRIS Software is in use to track and manage health workforce data, enabling better decision-making and real-time analytics.

The MOH collaborates with national and county governments, development partners, and private sector organisations to address human resource challenges. These efforts are part of a broader initiative to achieve UHC and strengthen the healthcare system in Kenya. Training institutions

exist with the responsibility for providing capacity building and enhancing services to healthcare sector workers, biomedical engineers and other players in the sector. These institutions implement standards and curriculums which are approved by the governing body and provide certification to validate the training/expertise provided. The MOH will take on a technical role in coordinating and overseeing the integration of oxygen production, plant repair and maintenance, delivery, and utilisation into the training curriculum for various health worker cadres, including the training of biomedical engineers.

In addition, the MOH will develop and deploy a standardized training manual, modules that are market relevant for health workers currently serving in the health facilities. There will be efforts to make this training available both in person and virtually on the MOH virtual academy. Additionally, a database will be established to track the respective trainings through the existing iHRIS that is currently being used to manage human resources by the MOH.

MOH DHPT and the MOH Community Health Division will also seek to influence the inclusion of medical oxygen components in the CHP training manual and community discussion guides.

2.8 FINANCING FOR MEDICAL OXYGEN

Medical oxygen represents a significant cost to hospitals in LMICs. These costs are attributed to high equipment costs, logistics for delivering medical oxygen, costs of electricity, a robust system for monitoring, repair and maintenance of equipment and need for licensed clinical staff to administer it. Cost barriers lead to oxygen intermittent unavailability in health facilities and can sometimes limit its use to patients and cause early discharge, this is compounded by the fact that most health facilities have no specific budget lines for medical gases or maintenance of medical gas equipment and devices

A study conducted by Ogot et al (2020) on 118 public, faith-based and private facilities in Kenya found that of the 285 hospitals studied, 50 percent charged for medical oxygen and 53 percent did not. Most of those who did not charge for oxygen were public hospitals. Patients' costs varied widely ranging from KES 500 to KES 34,000 per day. Providers cited affordability as one of the challenges they face in providing medical oxygen (Ogot, 2020).

The framework for charging oxygen used by patients has remained one of the challenges health facilities and service providers face when billing their patients. This is due to the intricate nature of its delivery, sources and utilization. However, determination of the exact cost of setting up oxygen PSA plants and LOX is challenging due to other critical requirements that would be necessary for their operation.

There should be clear guidelines for charging patients for oxygen based on consumption and cost of production. Financing models should be developed that offer oxygen at subsidized rates thus providing a secondary revenue to boost health facilities finances.

Health facilities, through the Facility Improvement Fund (FIF), will have autonomy over the revenues they collect. Health facilities will be able to create budget lines that will cover the cost related to the production and delivery of medical oxygen and the maintenance of related equipment. These budgets should consider costs beyond the initial capital requirement. The following considerations should be taken into account:

- I. **Cost of utilities:** These are costs associated with electricity and water consumption due to operating the equipment. A reliable power supply and backup systems should be accounted for as they are critical to support operations of the equipment
- II. **Service Level Agreement:** These are the costs associated with service contract after equipment warranty, if in-house maintenance is inadequate
- III. **Maintenance cost:** These are costs that cater for planned service kits, spare parts and accessories
- IV. **Technical training costs:** These are the costs to cater for need-driven trainings for technical personnel managing oxygen infrastructure
- V. **Calibration costs:** These are the costs associated with periodic calibration of plant gauges. This may include but not limited to procurement of oxygen analyzers and flowmeters
- VI. **Quality assurance costs:** Cylinder testing for quality and standards as per the guidelines
- VII. Costs related to **pharmacovigilance** survey on the status of the PSA, LOX, piping of the system and the cylinders

2.9 POLICIES AND GUIDELINES ON MEDICAL OXYGEN

A sufficient supply of medical oxygen is instrumental to an effectively functioning health system. To ensure that the medical oxygen produced and distributed for patients is of medical grade, is safe for use, the regulation of the drug is critical. A rethink of the medical oxygen policy and regulation space will deepen the access to medical oxygen in Kenya.

During COVID-19, supplementary oxygen was essential in the treatment of patients with severe COVID -19 disease. Kenya, just like other African countries, lacked sufficient supply of the commodity. The MOH focused on medical management of the disease to avert loss of life, with policy and regulations aspect on matters medical oxygen, the much-needed commodity, taking a backstage.

Post COVID, the country has embarked on improving the policy landscape and has produced four documents to guide the policy space:

- I. Guidelines on Production, Delivery and Management of Medical Oxygen in Kenya;
- II. Technical Specifications for Medical Oxygen, Oxygen Therapy Devices and Equipment;
- III. Guidelines for Establishing Manufacturing Facilities for Health Products & Technologies in Kenya by PPB; and
- IV. Kenya Good Manufacturing Practices Guidelines by PPB

The country continues to charge high taxes (input and import tax, VAT) on medical oxygen and oxygen equipment leading to inequality of access across the various health facilities. Through this Roadmap, various stakeholders will be able to advocate fair tax policies and regulations to improve access to medical oxygen.

This Roadmap acknowledges the following existing national regulations and standards covering quality and safety standards for medical oxygen. The Roadmap also acknowledges other strategic documents where medical oxygen is captured in their operational plans:

- I. Kenya Essential Medicines List, 2023
- II. Kenya National Medicines Formulary, 2023
- III. Clinical Guidelines for Management and Referral of Common Conditions
- IV. Kenya Bureau of Standards (KEBS) KS 2170-1:2023
- V. Guidance for inspection of manufacturers of Medical Gases
- VI. Kenya COVID-19 Health Emergency Response Project (CHERP), Ending in March 2025
- VII. Emergency Supply Chain for Health Products and Technologies Plan 2024
- VIII. Integrated management of newborn & childhood illness (IMNCI), 2023
- IX. Basic Paediatric Protocols 5th Edition 2022

2.10 ASSESSMENT OF THE MEDICAL OXYGEN LANDSCAPE

Currently, the medical oxygen landscape in Kenya is benefitting from functioning factors such as:

- I. A good working relationship between relevant stakeholders and partners in the health sector;
- II. Increased participation of the private sector in oxygen production;
- III. Increased investments to improve the oxygen infrastructure across the country;
- IV. Increased focus on medical oxygen therapy and their monitoring devices;
- V. Strengthened coordination and implementation of oxygen activities through HPTUs in the counties
- VI. M&E tools that track oxygen as a medical commodity enabling tracking of oxygen data from production, supply, to consumption and allowing end-to-end data visibility

Overall, the progress made in the medical oxygen landscape has laid a strong foundation, with significant strides in accessibility, infrastructure, and stakeholder collaboration. These achievements have strengthened the healthcare system's ability to respond to oxygen needs, particularly in critical settings. However, despite these successes, there remain several areas requiring further attention and improvement. Addressing these gaps is essential to ensuring a sustainable, equitable, and resilient medical oxygen supply chain across all levels of care.

- I. Insufficient budget allocations for medical oxygen infrastructure procurement, maintenance, and hiring biomedical engineers in public health facilities.
- II. Lack of harmonization in the regulation of medical oxygen, equipment, and accessories between key regulatory bodies such as KEBS and PPB.

- III. Absence of standardized national specifications for oxygen equipment and accessories to guide procurement, donations, and related processes.
- IV. Lack of local representatives of equipment manufacturers hindering ease of maintenance and limiting in-country capacity in terms of knowledge and skills for managing the equipment.
- V. No established accountability structures for tracking equipment, service kits, and other resources received by health facilities.
- VI. Diverse donations of equipment and products, leading to a variety of equipment in the country, which complicates procurement of accessories, spare parts, and maintenance.
- VII. Mismatch between workforce skills development and market demands particularly in the medical oxygen sector. Currently, there is limited expertise for accurately quantifying the supply and demand of medical oxygen.
- VIII. Inadequate capacity to regulate medical oxygen including infrastructure, human resources, product standards, and nomenclature. Many county Health Products and Technologies Units (HPTUs) do not include medical engineers in their decision-making.
- IX. Lack of robust quality assurance mechanisms for medical oxygen, including the absence of oxygen analysers and a lack of planned market surveillance.
- X. Limited innovation in the local context with too much focus on manufacturing rather than broader technological and operational improvements.

2.11 PRIORITIES FOR KENYA'S MEDICAL OXYGEN LANDSCAPE

In developing Kenya's medical oxygen Roadmap, the team conducted a thorough assessment of the local landscape and examined Roadmaps from other African countries and identified the best practices and successful strategies. By analysing these regional approaches, the team has borrowed key insights and adapted them to the Kenyan context. The recommendations presented below are based on lessons learnt, tailored to meet Kenya's specific needs for enhancing the availability, distribution, and management of medical oxygen.

- I. Conduct activity-based costing and budgeting to ensure efficient use of resources and funding for oxygen infrastructure.
- II. Ensure sustainable financing mechanisms for the continuous availability of medical oxygen, including adequate financial allocation for infrastructure and equipment maintenance.
- III. Establish and enforce legal and regulatory frameworks for medical oxygen
- IV. Develop systems for logistics and spare parts management including accessories and consumables, with improved procurement processes and standardized oxygen equipment inventories.
- V. Evaluate and strengthen the oxygen supply chain incorporating better logistics management systems, manuals, SOPs, and integrating oxygen data into national health information systems.
- VI. Enhance workforce capacity: Implement in-service training programs covering hypoxemia management, oxygen therapy, and logistics, and ensure a trained workforce of biomedical engineers and technicians with adequate equipment, spare parts, and tools.

- VII. Equip clinical staff with training and tools (e.g., pulse oximeters) to safely administer oxygen, monitor treatment, detect hypoxemia, and manage patient referrals.
- VIII. Improve monitoring and reporting systems ensuring oxygen-related data collection tools capture key indicators and that monitoring equipment like pulse oximeters and patient monitors are widely available.
- IX. Develop patient education materials including home-based care guides and brochures in national languages or local dialects to promote the safe use of oxygen therapy at home.
- X. Promotion of research and innovation to utilize current technology in oxygen therapy.

CHAPTER 3: STRATEGIC DIRECTION

3.1 GOAL

The overall goal of the Kenya Medical Oxygen Roadmap 2025 – 2030 is to ensure all Kenyans have access to quality, sustainable and affordable medical oxygen by the year 2030 as envisaged in the Kenya Health Policy 2014-2030.

3.2 STRATEGIC OBJECTIVES

To achieve the overall goal of quality access to sustainable and affordable medical oxygen, the MOH will pursue the following objectives:

- I. Strengthen governance, coordination and management of the medical oxygen ecosystem
- II. Strengthen implementation and adherence to medical oxygen policies, guidelines and regulations.
- III. Enhance safe production, distribution, transport, handling and use of medical oxygen.
- IV. Avail appropriate and well-maintained infrastructure for medical oxygen generation, distribution, and storage at different levels of care.
- V. Ensure availability and management of all related respiratory care devices and equipment for the safe delivery of medical oxygen.
- VI. Ensure the availability of adequate numbers of well-skilled personnel for the maintenance, clinical management, and sustainability of safe oxygen practices.
- VII. Ensure adequate and sustainable financing for production, storage, distribution, training and maintenance of medical oxygen and related devices at all levels of care.
- VIII. Strengthen equitable access and quality management for medical oxygen.
- IX. Enhance monitoring, evaluation, and research to improve the quality, production, and regulatory adherence in the use of medical oxygen.

3.3 STRATEGIC INTERVENTIONS

Governance, Management and Coordination

Strong leadership in the health sector is essential to improving access to medical oxygen by driving policy, strengthening systems, and fostering collaboration. Effective leadership ensures equitable distribution, workforce capacity, and innovation, prioritizing medical oxygen as a vital component of healthcare delivery.

Strategic objective 1: Strengthen governance, coordination and management of the medical oxygen ecosystem

Strategic interventions

- SI 1.1: Enhance governance mechanisms for medical oxygen at national and county level
- SI 1.2: Enhance inter/intra sectoral collaboration and partnerships on medical oxygen
- SI 1.3: Strengthen coordination with relevant stakeholders

Regulations, Guidelines and Policies

Robust policy and legislative frameworks are crucial to effectively guide the medical oxygen ecosystem. These frameworks ensure clear standards, promote adherence, and support sustainable practices. Strengthening compliance mechanisms is vital for reliable and equitable medical oxygen access.

Strategic objective 2: Strengthen implementation and adherence to medical oxygen policies, guidelines and regulations

Strategic interventions

- SI 2.1: Improve the management of medical oxygen

Systems for Medical Oxygen Production, Storage, Transport, Distribution and Delivery

Oxygen systems are critical components of healthcare infrastructure, encompassing the processes of production, storage, transport, distribution, and delivery of medical oxygen. These systems ensure a reliable supply to healthcare facilities, enabling timely and effective treatment. Strengthening these systems is essential to improving health outcomes and supporting resilient healthcare delivery.

Strategic objective 3: Enhance safe production, distribution, transport, handling and use of medical oxygen

Strategic interventions

- SI 3.1: Ensure availability of adequate medical oxygen in health facilities
- SI 3.2: Strengthen delivery of medical oxygen to the point of use
- SI 3.3: Strengthen the safe and efficient transportation of medical oxygen

Management and maintenance of medical oxygen infrastructure

Medical oxygen infrastructure refers to the systems and facilities needed to produce, store, transport, and deliver oxygen for medical use. It is a critical part of healthcare, ensuring patients have access to life-saving oxygen when needed. Strong infrastructure is essential for reliable and efficient medical oxygen delivery.

Medical equipment management and maintenance can be enhanced through a reliable spare parts supply chain, targeted training programs, and continuous upskilling pathways for biomedical engineers and technicians. This will ensure uninterrupted operation. There is a need to strengthen medical equipment management and maintenance systems by establishing a reliable spare parts supply chain, enhancing the capacity of biomedical engineers and technicians through targeted and market-relevant training, and adopting best practices in alignment with existing guidelines to ensure uninterrupted operation of medical devices.

Strategic objective 4: Avail appropriate and well maintained infrastructure for medical oxygen generation, distribution, and storage at different levels of care

Strategic interventions

- SI 4.1: Inform and advocate for investments in medical oxygen infrastructure
- SI 4.2: Strengthen planned preventive maintenance practices and risk mitigation
- SI 4.3: Ensure inventory management plan with up to date list of spare parts

Accessories, Devices and Equipment for Medical Oxygen Therapy

Respiratory medical devices and inventory refer to the equipment used to manage respiratory conditions. Effective management of these devices and their inventory ensures timely access to essential resources, preventing shortages and supporting quality patient care.

Strategic objective 5: Ensure availability and management of all related respiratory care devices and equipment for the safe delivery of medical oxygen

Strategic interventions

- SI 5.1: Ensure availability of respiratory care accessories, devices, equipment and spare parts
- SI 5.2: Ensure the management of respiratory care accessories, devices, equipment and spare parts

Staff

Human Resources for Health (HRH) in the context of oxygen refers to the workforce involved in the production, management, and delivery of medical oxygen. Ensuring a well-trained and adequately staffed workforce is crucial for maintaining oxygen systems, managing inventory, and delivering oxygen effectively to patients. Strengthening HRH in this area is essential for ensuring reliable access to oxygen and improving patient care outcomes.

Strategic objective 6: Ensure the availability of adequate numbers of well-skilled personnel for the maintenance, clinical management, and sustainability of safe oxygen practices

Strategic interventions

SI 6.1: Increase availability of adequate numbers of staff to support medical oxygen ecosystem

SI 6.2: Enhance skills and competencies on medical oxygen for in service staff

Financing for Medical Oxygen

Financing medical oxygen involves capital for the production, storage, and distribution of medical oxygen. This includes investments in plants, storage systems, and delivery networks, supported by government, private partnerships, and grants, ensuring affordable access,

Strategic objective 7: Ensure adequate and sustainable financing for the production, storage, distribution, training and maintenance of medical oxygen and related devices at all levels of care

Strategic interventions

SI 7.1: Increase funds for medical oxygen production, storage, distribution, training and maintenance of medical oxygen and related devices at all levels of care

Service Delivery and Quality Assurance

Service delivery for medical oxygen involves efficient provision, timely delivery, and proper storage of oxygen to healthcare facilities and patients. Quality assurance ensures that oxygen meets medical-grade standards, is stored correctly, and is administered safely through regular testing and compliance with regulations. Together, these processes guarantee reliable access to oxygen and maintain patient safety and treatment effectiveness.

Strategic objective 8: Strengthen equitable access and quality management for medical oxygen

Strategic interventions

SI 8.1: Institute mechanisms to ensure quality of medical oxygen from point of production to the point of use

SI 8.2: Improve equitable access of medical oxygen through efficient distribution systems

Monitoring, Evaluation and Research

Monitoring and evaluation of oxygen systems involve assessing their performance, availability, and quality across production, storage, distribution, and delivery. It ensures compliance with standards, identifies gaps, optimizes resources, and improves the efficiency of oxygen delivery to enhance health outcomes.

Strategic objective 9: Enhance monitoring, evaluation, and research to improve the quality, production, and regulatory adherence in the use of medical oxygen

Strategic interventions

SI 9.1: Strengthen monitoring and evaluation in the medical oxygen ecosystem

SI 9.2: Enhance research and learning around medical oxygen in Kenya

CHAPTER 4: IMPLEMENTATION ARRANGEMENTS

4.1 LEADERSHIP AND MANAGEMENT AT NATIONAL LEVEL

The execution of this Roadmap involves multiple stakeholders. The MOH will take the responsibility of leading and coordinating activities to ensure the availability and accessibility of high-quality medical oxygen for all Kenyans by the year 2030.

The MOH will provide overall stewardship, lead the formulation of policies, standards, and regulations, and facilitate capacity building for national referral facilities.

4.2 LEADERSHIP AND MANAGEMENT AT COUNTY LEVEL

Health Products and Technologies Units (HPTUs) within the County Health Management Team (CHMT) coordinate health products management. Medical oxygen, listed as an essential health commodity in the WHO EML and KEML 2023, is part of their responsibilities. HPTUs organize, monitor, and support all supply chain activities for medical oxygen and manage partnerships to ensure its consistent supply to patients. The Health Management Teams will handle the day-to-day management of medical oxygen, including budgeting for and overseeing the administration of maintenance services for medical equipment generating medical oxygen. Other stakeholder roles at this sub-national level are shown in Table 5.

Table 5: Leadership and management of medical oxygen at county level

Unit	Role in the management of medical oxygen
Office of the Governor	I. Approval of MOUs with partners in the medical oxygen sector II. Convening of executive committee meetings III. Provide guidance on priority investment areas as guided by the County Integrated Development Plan IV. Mobilise resources for investments in medical oxygen
County Executive Committee	I. Provide priority areas for the health department II. Ensure implementation of policies relevant to medical oxygen III. Update the Office of the Governor on the status of medical oxygen in the county
County Assembly	I. Approve budgets for investment in medical oxygen II. Provide oversight on medical oxygen infrastructure investments III. Legislation on medical oxygen investments at county level IV. Citizen engagement on medical oxygen matters
County Health Management Teams	I. Coordinate medical oxygen management in health facilities in the county II. Coordinate and engage partners in the medical oxygen sector III. Consolidate budgets for medical oxygen from all sub-counties.

	IV. Supervise medical oxygen related activities V. Disseminate policies, guidelines and regulations on medical oxygen to sub-counties
Sub County Health Management Team	I. Coordinate medical oxygen management in health facilities in the sub-county II. Coordinate and engage partners III. Consolidate all budget for medical oxygen from all facilities within the sub-county IV. Supervision and capacity building on medical oxygen related activities
County HPTU	I. Manage medical oxygen supply chain related activities including planning and monitoring II. Conduct forecasting and quantification of medical oxygen and related equipment & inventory III. Conduct continuous medical oxygen quality assessments IV. Conduct supportive supervision and redistribution V. Conduct capacity building related to medical oxygen
Health Facility Management Teams	I. Handle day to day management of health services II. Generate plans and budget for maintenance of medical oxygen plants and infrastructure III. Prioritise and budget for medical oxygen within their annual facility work plans.

4.3 COORDINATING MECHANISMS

Interagency coordinating committee

An existing Health Products and Technologies (HPT), Supply Chain, and Infrastructure - Interagency Coordinating Committee (ICC) unites the national and county governments and various partners with a focus on health products and technologies.

This HPT ICC is co-chaired by representatives from both the national and county governments and includes stakeholders from the MOH; Semi-Autonomous Government Agencies (SAGAs) such as Kenya Medical Supplies Authority (KEMSA), Pharmacy and Poisons Board (PPB), and Kenya Biovax; the Council of Governors; County Governments (CECs Caucus); the Kenya Healthcare Federation (KHF); Hennen; Development Partners for Health in Kenya (DPHK); and the FBO consortium.

Medical oxygen Partners' Alliance

Partners in this Roadmap are non-state actors supporting Government initiatives to enhance access to medical oxygen. Their responsibilities span the entire medical oxygen ecosystem and are not confined to a single sector.

At present, partner coordination is inadequate, with interactions occurring on a needs basis. The Roadmap recommends establishing a national Medical Oxygen Partners' Alliance. This alliance, led by partners and coordinated by the MOH, will convene regularly to discuss the status of medical oxygen and related equipment within the country.

Leadership within the alliance will rotate among members, while the secretariat duties will be jointly managed by the selected partner organization and the MOH-DHPT. This approach ensures MOH oversight and guidance on initiatives and maintains institutional memory of previous interventions.

Proposed Initiatives under the Alliance

To enhance coordination, a medical oxygen dashboard providing real-time updates on partner status, infrastructure investments, and functionality will be developed and maintained by MOH. An annual convention will be held to share progress, innovations, and challenges in the oxygen ecosystem, bringing together governments, partners, suppliers, manufacturers, clinicians, regulators, and training institutions.

Medical oxygen Taskforce

The current governance structures are adequate for overseeing the medical oxygen ecosystem. Should the need arise, a temporary task force can be established to address particular aspects.

4.4 IMPLEMENTATION PLAN

This Roadmap is aligned with the Kenya Health Policy 2014 – 2030. The implementation framework included in the Annex details the strategic objectives, strategic interventions, activities and the timing of the implementation of the activities.

CHAPTER 5: COSTING AND RESOURCE MOBILIZATION

5.1 COSTING THE KENYA MEDICAL OXYGEN ROADMAP

Ensuring a sustainable supply of medical oxygen is vital for the health and well-being of Kenya's population. This section of the Kenya Medical Oxygen Roadmap provides an estimate of the financial requirements necessary to establish, maintain, and expand medical oxygen infrastructure across the country over the lifetime of the Roadmap.

An activity-based costing approach was used to cost the implementation of this Roadmap. The total budget for the project implementation from the year 2025 to 2030 is **KES 37 billion**. Much of this budget is allocated to the thematic area addressing systems for production, storage, transport, distribution, and delivery of medical oxygen. This area accounted for 87 percent of the total budget. Other significant allocations include the thematic area on *management and maintenance of medical oxygen infrastructure* (8 percent). Table 6 below summarizes the financial requirements per thematic area.

These two thematic areas which constitute 95 percent of the total budget are relatively high due to the capital requirements required in their implementation. For instance, the thematic area of *production, storage, transport, distribution, and delivery systems for medical oxygen* accounts for the largest proportion of the total budget due to the planned procurement and installation of equipment such as LOX tanks, PSA plants, piping, and manifold systems. This procurement alone accounts for KES 32 billion of the total budget. The Annex section presents an implementation plan with costed activities.

Table 6: Annual resource requirements for the implementation of the Kenya Medical Oxygen Roadmap (in KES, Million)

Thematic area	2025	2026	2027	2028	2029	2030	Total	% of total budget
Governance, management and coordination	19.6	20.2	44.9	42.0	19.0	20.4	166.1	0.4%
Regulations, guidelines and policies	7.8	34.9	52.7	56.4	53.5	57.3	262.6	0.7%
Systems for production, storage, transport, distribution and delivery of medical oxygen	5,077.2	5,798.1	5,097.9	5,113.4	5,471.4	5,766.2	32,324.2	87.4%
Management and maintenance of medical oxygen infrastructure	376.4	545.4	583.6	461.1	493.4	527.9	2,987.8	8.1%
Accessories, devices and equipment for medical oxygen therapy	-	13.1	14.0	8.6	9.2	9.9	54.8	0.1%
Staff	32.0	34.2	31.1	31.1	33.3	35.6	197.2	0.5%
Financing for medical oxygen	22.0	27.3	16.9	12.8	13.7	1.8	94.6	0.3%
Service delivery and quality assurance	42.7	53.5	48.7	45.8	43.0	46.1	279.8	0.8%
Monitoring, evaluation and operational research	21.4	127.9	88.8	163.4	98.6	125.0	625.0	1.7%
Grand Total	5,599.1	6,654.5	5,978.6	5,934.6	6,235.2	6,590.1	36,992.1	100.0%

5.2 RESOURCE MOBILIZATION PLAN

This Roadmap outlines a phased approach to resource mobilization for the medical oxygen ecosystem, emphasizing local production and consumption. To ensure sustainable financing, it proposes increasing government funding, optimizing the use of existing resources, and fostering new partnerships with the private sector.

Medical oxygen financing will be systematically integrated into government planning processes, including annual work plans, the County Integrated Development Plan (CIDP), and the Health Sector Strategic and Investment Plan (HSSIP), ensuring a structured and incremental approach to funding. Additionally, medium- and long-term financing strategies will be explored to secure sustained investment in medical oxygen infrastructure.

Innovative solutions such as solarization and digitization will be leveraged to reduce costs while enhancing the quality and capacity of medical oxygen production. Lessons from these efforts will be documented and translated into policy and technical recommendations to guide future investments and improvements. The following options are potential resources for executing the Roadmap and ensuring its sustainability:

1. Government resources:

Medical oxygen financing will be supported through multiple funding mechanisms:

- I. **Exchequer transfers** – Direct allocations from the National Government to counties as part of shareable revenue. These funds enable counties to fulfil their healthcare mandates, including the provision of medical oxygen.
- II. **Conditional grants** – Funds provided by the National Government or development partners, tied to specific activities. Conditional grants can explicitly include medical oxygen supply, infrastructure, and maintenance, ensuring targeted investment in oxygen systems.
- III. **County budget allocations** – Counties will incorporate medical oxygen into their annual health sector budgets. This ensures that oxygen procurement is factored into the annual quantification of health products, supporting long-term planning for oxygen availability.
- IV. **Facility-generated revenue** – Under the 2023 Facility Improvement Financing (FIF) Bill, public health facilities will be able to now retain 100 percent of their internally generated funds, including reimbursements from insurance and user fees. These funds will enable facilities to procure medical oxygen, maintain PSA plants and concentrators, and restock oxygen cylinders. Facility management committees and hospital boards are responsible for budget allocation and expenditure approvals.
- V. **Taifa Care and health insurance funds** – Kenya's transition from NHIF to funds under the Social Health Authority (SHA) introduces a comprehensive, equitable health insurance system. The pharmacy benefits package is being finalized, ensuring medical oxygen is covered as a reimbursable commodity. Efforts are underway to develop standardized oxygen utilization and costing methods, while exemptions will apply for maternal, neonatal,

and child health (MNCH), children under five, and TB patients, funded through national programs.

2. Private insurance covers

Both public and private health facilities that charge for oxygen can receive reimbursements from private medical insurance providers, ensuring continued availability of medical oxygen for patients. Since medical oxygen pricing varies across facilities, its cost is typically included in Memorandums of Understanding (MOUs) with insurers. The Roadmap proposes formalizing this process by explicitly incorporating medical oxygen as a Fee-for-Service item, ensuring standardized reimbursement and improving financial sustainability for facilities providing medical oxygen.

3. Public private partnerships (PPP)

The Public-Private Partnerships (PPP) Act 2015 enables collaboration between County Governments, health facilities, and the private sector to enhance oxygen availability. A simplified framework can be developed from this Act to facilitate structured agreements, ensuring mutual benefits. Key advantages of PPPs in medical oxygen provision include:

Equipment access without upfront costs – Counties and facilities can acquire oxygen equipment through leasing arrangements rather than outright purchases, reducing financial strain.

Vendor-managed maintenance – Private vendors handle routine repair and maintenance, ensuring continuous functionality and reducing the burden on facility staff.

User fees cover lease costs – If well-structured, patient fees can sustain lease payments, making the model financially viable.

4. Development partners

Since the COVID-19 pandemic, there have been a lot of concerted efforts by various partners to support increased access to medical oxygen. This was mostly done by having PSAs plants and installation of bulk LOX tanks in public and faith-based hospitals. There are several initiatives geared towards enhancing access to liquid oxygen which are largely donor supported. The Roadmap proposes to have better partner coordination as well as to seek more investments into the medical oxygen ecosystem.

5. Private sector investment

Private sector investment in LOX ASUs, and PSA plants is a strategic initiative to enhance medical oxygen production and distribution while bridging gaps in supply. LOX ASUs decentralize oxygen production, reducing transportation costs and ensuring regional availability during emergencies, with investments of US\$ 5 to US\$ 15 million per plant covering cryogenic storage, compressors, and distribution systems.

PSA plants, on the other hand, provide scalable and localized production near healthcare facilities or high-demand areas, reducing dependence on centralized supply chains. Both technologies can be rapidly deployed during emergencies, such as pandemics or natural disasters, to meet surges in demand. Revenue streams from these plants include bulk supply to hospitals, cylinder refilling, industrial oxygen sales, and long-term service contracts. This dual investment approach aligns with the nationwide oxygen Roadmap by leveraging private sector capabilities to ensure sustainable, resilient, and accessible oxygen infrastructure while enhancing public health outcomes.

6. Financial institutions

Financial institutions play a key role in making medical oxygen more accessible by offering different types of funding and support:

- I. **Commercial banks** – Help fund large-scale projects like PSA plants and cryogenic ASUs by offering loans, leasing options, and working capital. They can also support hospitals in buying and maintaining oxygen equipment. Through PPPs, banks can help governments and private investors collaborate on expanding oxygen production and supply.
- II. **Microfinance Institutions (MFI)** – Focusing on small clinics, rural hospitals, and local entrepreneurs, MFIs can provide flexible loans for mini-PSA plants, portable concentrators, and cylinder refilling stations in underserved areas. Their smaller loans and easier repayment terms make oxygen more available where it's needed most.
- III. **Venture capital firms** – They can invest in startups developing new oxygen solutions, like energy-efficient generators, compact concentrators, and smart logistics platforms. Beyond funding, they can provide expertise to scale up innovative ideas that can improve oxygen access in remote or resource-limited settings.

7. Private donors and foundations

Individual donors and foundations play a crucial role in supporting healthcare by investing in capital projects such as buildings and renovations, as well as donating medical equipment and devices. These contributions are often aimed at improving health outcomes in specific communities or areas of interest. By providing financial support where it's most needed, they can contribute to strengthening healthcare systems, enhancing the quality of care, and ensuring that medical facilities have the resources necessary to serve their patients effectively.

CHAPTER 6: MONITORING AND EVALUATION

Monitoring and Evaluation is useful in generating information needed for evidence-based decisions at national and county levels. This monitoring and evaluation plan will be useful in providing information on the progress towards achieving the set targets and goal. In addition, the M&E framework will systematically track the progress of suggested interventions and assess the effectiveness, efficiency, relevance, suitability and sustainability of the proposed interventions.

The implementation of the Kenya Medical Oxygen Roadmap 2025-2030 will be continuously and regularly monitored to ensure that the strategic objectives, interventions and activities are performed as planned. The framework is anchored on the strategic objectives and presents indicators in the various levels of the results chain (inputs, processes/activities, outputs, outcomes and impact) and will be useful to track the outputs, outcomes and potential impacts in relation to the set goals and objectives.

This framework provides a description of the indicators selected for monitoring and evaluation; data collection methods, reporting and feedback mechanisms. Towards monitoring, the framework outlines the process regarding when, how, by whom and type of data that will be collected including the frequency and the timeline for program performance reviews with stakeholders. On the other hand, a baseline, mid-term and end term evaluation are envisioned to provide an understanding of the outcomes and impacts of the program over time, analyzing whether the intended objectives are being achieved. Together, the M&E processes will provide valuable insights into the availability, accessibility, and utilization of oxygen services across healthcare facilities providing a comprehensive view of the program's effectiveness and sustainability.

Data will be obtained from routine and non-routine sources utilizing both qualitative and quantitative methods and employ standardized data collection tools and analysis techniques. Most data will be collected routinely with survey-based indicators largely collected at baseline, midterm and at the end of implementation of the Roadmap. This framework anticipates that the relevant reporting tools will be availed to levels of the health system to facilitate harmonized and complete reporting. Supportive supervision will be strengthened to enhance appropriate use of reporting tools and review of collected data for quality.

Effective data dissemination is crucial in M&E as it transforms data into actionable insights for stakeholders. Dissemination of information through various formats and channels is emphasized in this framework to ensure that all stakeholders receive information to allow informed decision-making, enhance accountability, and contribute to continuous improvement of the programs as they contribute to the common goal of “ensuring quality access to sustainable and affordable medical oxygen by the year 2030”. Table 7 and 8 below suggests how the Roadmap will track its progress across the period of implementation. The output indicators against the various activities are presented in Annex 2.

Table 7: Impact level indicators and targets

Result area	Indicator	Baseline target	End term target	Data source	Responsible
Reduced morbidity and mortality in children	Neonatal Mortality Rate (per 1000 live births)	21	15	KDHS	MOH
	Under Five Mortality Rate (per 1000 live births)	41	30	KDHS	MOH
Reduction of maternal deaths	Maternal Mortality Ratio (per 100,000 live births)	355	200	KDHS/ Census	MOH/ KNBS
Reduction of mortality due to NCDs (Cardiovascular, Cancer, Diabetes and COPD)	NCD Mortality Rate (per 100,000 population)	39	27	Global Burden of Disease (GBD) and WHO estimates	MOH

Table 8: Outcome indicators and targets

Result area	Indicator	Baseline*	Mid-term*	End term*	Data source	Responsible
Screening for oxygen saturation	Proportion of patients screened for hypoxemia at initial assessment (disaggregated by age, sex etc.)					
	Proportion of patients with oxygen saturation of < 90 percent at initial assessment					
Coverage of oxygen therapy for hypoxemic patients	Proportion of hypoxemic patients that received medical oxygen therapy (disaggregated by age, sex, medical wards)					
	Proportion of deaths due to hypoxemia					
Availability of medical oxygen and medical oxygen infrastructure	Proportion of health facilities with medical oxygen sources (disaggregated by cylinders, plants, LOX, concentrators) disaggregated by level of care					
	Proportion of health facilities with medical oxygen piping to points of use - Wards, In-patient beds, ICU and Theatre, disaggregated by levels of care					

Result area	Indicator	Baseline*	Mid-term*	End term*	Data source	Responsible
	Proportion of health facilities with functional Pulse Oximeters					
	Percentage of Counties with investments for medical oxygen in their County Integrated Development Plans					
	Annual medical oxygen production in gaseous form (in Billion Liters)	12	40	64		
Improved data, information use and monitoring	Proportion of health facilities reporting on medical oxygen indicators in KHIS (percent)	5	60	80		
Quality of medical oxygen	Proportion of health facilities with oxygen sources meeting medical oxygen purity standards (KEBS and WHO), disaggregated by source (Data Source: PPM daily Logs)					
	The proportion of oxygen supplied with a purity of at least 99.5 percent for cryogenic, 93± 3percent for PSA and concentrators					

Result area	Indicator	Baseline*	Mid-term*	End term*	Data source	Responsible
	Disaggregation: Equipment, Source, facility					
Staff capacity	Proportion of health facilities with health providers (health facility team) trained in medical oxygen therapy					
	Proportion of health facilities with technical staff (BME) trained in medical oxygen system operations and maintenance					

*Baseline: 2025; Mid-term: 2027; End term: 2030

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APPENDICES

APPENDIX 1:

	Name	Organisation
1	Dr. Tom B. Menge	Ministry of Health
2	Dr. Jonah Maina	Ministry of Health
3	Dr. Eunice Gathitu	Ministry of Health
4	Dr. Gerald Macharia	Ministry of Health
5	Dr. Makoyo Bota	Ministry of Health
6	Richard Gatukui	Ministry of Health
7	Dr. Stephen Njuguna	Ministry of Health
8	Anna Rose Gitau	Ministry of Health
9	Dr. Hannah Kagiri	Ministry of Health
10	Mary Ngugi	Ministry of Health
11	Margaret Mundia	Ministry of Health
12	Alice Machanga	Ministry of Health
13	Patrick Chepkonga	Kenyatta National Hospital
14	Nelly Hildah Owola	Busia County
15	Dr. Nicole Wamaitha	Kiambu County
16	Dr. Caroline Kaeni Mwathii	Makueni County
17	Dr. Claver Kimathi	Isiolo County
18	Ashiemi Alfred	Nairobi County
19	Dr. Oscar Agoro	Nyeri County
20	Symon Mbakah	Association of Medical Engineers in Kenya (AMEK)
21	George Walukana	Kenya Medical Supplies Authority (KEMSA)
22	Dr. Angela Ndaga	Amref Health Africa
23	Betty Wariari	Clinton Health Access Initiative (CHAI)
24	Brian Mokaya	Clinton Health Access Initiative (CHAI)
25	Collins Cheruiyot	Clinton Health Access Initiative (CHAI)
26	Linnet Kyule	Jhpiego
27	Ruth Njuguna	Topcare Oxygen
28	Anyango Philip	Oxygen Alliance
29	Phoebe Khagame	Oxygen Alliance
30	Etse-Hiwot Girma	Oxygen Hub
31	Clayton Opiyo	PATH
32	Eunice Gathoni	PATH
33	Helen Kamau	PATH
34	Jacinta Wachira	PATH
35	Janet Shauri	PATH
36	Vanessa Adam	PATH
37	Peter Abwao	PATH

APPENDIX2: ASSUMPTIONS FOR DEMAND AND SUPPLY QUANTIFICATION

A table detailing the prevalence (cases) of hypoxemic diseases in Kenya in 2024, categorized by medical oxygen administration dosage and estimated annual consumption

<i>Disease area</i>	<i>Workload adjusted for need¹</i>	<i>Estimated flow rate²</i>	<i>Estimated admission duration³</i>	<i>Total oxygen needed per year⁴</i>
<i>Premi 28-31</i>	45,250	21	5	6,841,800,000
<i>Surgeries (ICU and HDU)</i>	582,442	0.5	6	6,290,373,600
<i>PPH</i>	92,160	7	7	3,317,760,000
<i>Premi <28</i>	15,000	28	53	3,024,000,000
<i>Severe pneumonia</i>	80,276	7	5	2,889,936,000
<i>Asthma</i>	44,127	3	5	1,588,572,000
<i>A&E</i>	90,000	1	10	1,296,000,000
<i>Premi 32-37</i>	19,229	14	2	775,313,280
<i>OPD</i>	100,000	1	5	720,000,000
<i>Malaria</i>	18,517	7	5	666,612,000
<i>Sepsis</i>	3,740	7	5	188,496,000
<i>Anaemia</i>	1,546	3	6	40,072,320
<i>Asphyxia</i>	3,894	5	1	28,036,800
<i>Referrals</i>	29,635	0.05	6	12,802,320
<i>Meningitis</i>	120	7	7	4,320,000
<i>Total estimated oxygen need = (a)⁵</i>				27,684,094,320 L
<i>Adjust total need (a) for reporting rate = (b)⁶</i>				40,141,936,764 L
<i>Adjust (b) for care seeking in the private sector = (c)⁷</i>				64,227,098,822 L

Source: KHIS, MOH treatment guidelines

1 – Workload (i.e. cases reported) adjusted for need

2 – Units for Flowrate is litres per minute

3 – Units for duration is days

4 – Units for total oxygen needed is litres

5 - Estimate based on case load for diseases areas or conditions that require oxygen

6 – Assume 60 percent reporting rate in the DHIS

7- Assume 60 to 70 percent of demand is sought in public health facilities (KDHS)

Table showing the total production capacity of medical oxygen in Kenya, by 2024

Source		Notes	Capacity ¹
Liquid oxygen	Local production	From 20 ton per day existing installed capacity from local manufacturers. Local production set to have an increase of ~10B litre per year by 2026	5,122,807,018
	Import	Estimates 9 tons/day imported	2,305,263,158
PSA	Public sector	From 47 functional plants running on average 12 hours per day	3,030,644,166
	Private sector	From private producers using PSA commercially	1,591,582,500
Total oxygen production			12,050,296,842 L

Source: CHAI - Hypoxaemia facility baseline assessment 2023

1 – Capacity units is Litres in vapor form

ANNEX

ANNEX 1: IMPLEMENTATION PLAN WITH COST ESTIMATES

This table presents the timing of activity implementation and the associated costs. Figures are in millions, KES.

Strategic Interventions		Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn, KES)
1		Governance, management and coordination							
Strategic objective		Strengthen governance, coordination and management of the medical oxygen ecosystem							
1.1	Enhance governance mechanisms for medical oxygen at national and county level	Hold quarterly meetings with the medical oxygen partners coalition	X	X	X	X	X	X	11.7
1.2	Enhance inter/intra sectoral collaboration and partnerships on medical oxygen	Integrate medical oxygen as an agenda in the HPT-ICCs	X	X	X	X	X	X	32.2
		Develop a framework to guide MOUs at county level for medical oxygen systems	X	X					2.5
		Appoint a medical oxygen focal person at county	X	X					0
1.3	Strengthen coordination with relevant stakeholders	Incorporate medical oxygen related activities into County Annual Workplans	X	X	X	X	X	X	60
		Map medical oxygen stakeholders at national and county levels	X						1.3
		Review and include medical oxygen in the MOH Emergency HPT list	X	X					1.9
		Disseminate the Kenya Medical Oxygen Roadmap	X	X	X				5.5
		Conduct community-based educational campaigns to raise awareness about the safety and benefits of medical oxygen therapy		X	X	X			51.1
2		Regulations, guidelines and policies							
Strategic objective		Strengthen the implementation and adherence to medical oxygen policies, guidelines, and regulations							
2.1	Improve end-to-end management of medical oxygen	Develop training materials on the regulation of medical oxygen, oxygen devices, and oxygen quality-customized GMPs for hospitals and manufacturers producing oxygen	X	X	X				13.5

Strategic interventions		Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn, KES)
		Train health workers at county and health facilities on the management of medical oxygen, oxygen devices and quality assurance	X	X	X	X	X	X	229.3
		Develop SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure	X	X					4.6
		Disseminate SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure		X	X	X			15.2
Thematic area		Systems for production, storage, transport, distribution and delivery of medical oxygen							
Strategic objective		Enhance safe production, distribution, transport, handling and use of medical oxygen							
3.1	Strengthen the safe and efficient transportation of medical oxygen	Install optimal piping and/or manifold infrastructure in public health facilities as per guidelines	X	X	X	X	X	X	32,271.6
		Procure medical oxygen delivery devices for public health facilities	X	X	X	X	X	X	52.6
		Train health workers (Technicians and Engineers) on transportation, storage and handling of medical oxygen	X	X	X				Costed in theme 6 on Staff
		Conduct safety simulations/drill exercises for the transportation, storage and handling of oxygen		X	X	X	X	X	Costed in theme 6 on Staff
Thematic area		Management and maintenance of medical oxygen infrastructure							
Strategic objective		Avail appropriate infrastructure for medical oxygen generation, distribution, and storage at different levels of care							
4.1	Use evidence to inform investments in medical oxygen infrastructure	Conduct a needs assessment for medical oxygen infrastructure to inform decision making	X	X					Costed in theme 9 on M&E
		Develop guidelines for hospital building plans that incorporate medical oxygen infrastructure		X	X				17.2

Strategic interventions	Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn, KES)
	Develop standard guidelines for PPM tool kit by facility level		X	X				7.1
4.2	Strengthen planned preventive maintenance (PPM) practices			X	X	X	X	2,896.4
	Equip medical engineering workshops as per the PPM tool kit guidelines			X	X	X	X	15.8
	Support procurement of devices, accessories and spare parts for oxygen related equipment	X	X	X	X	X	X	51.2
	Service the medical oxygen equipment and infrastructure as per the schedule	X	X	X	X	X	X	
Accessories, devices and equipment for medical oxygen therapy								
Thematic area	Accessories, devices and equipment for medical oxygen therapy							
Strategic objective	Ensure availability and management of respiratory care accessories, devices and equipment for the safe administration of medical oxygen							
5.1	Increase availability of respiratory care accessories, devices and equipment	X	X					Costed in theme 9 on M&E
	Conduct an assessment on the availability of respiratory care accessories, devices and equipment	X	X	X	X	X	X	Costed in theme 4 on Mgt. & Maintenance
5.2	Support procurement of respiratory care accessories, devices and equipment to ensure continuity of services	X	X	X	X	X	X	42.8
	Develop a digital inventory for all respiratory devices for proper management		X	X	X	X	X	0.6
	Conduct periodic updates to the digital inventory tool		X	X	X	X	X	11.4
	Develop SOPs for disinfection, reuse, decommissioning and disposal of devices for medical oxygen		X	X				
	Disseminate SOPs relevant to management of medical oxygen			X	X			Costed in theme 6 on Staff

Strategic Interventions		Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn, KES)
Thematic area		Staff							
Strategic objective		Ensure the availability of adequate numbers of well-skilled personnel to support the medical oxygen ecosystem							
6.1	Enhance skills and competencies on medical oxygen for in service staff	Develop a training curriculum, training materials and job aids for in-service training for all relevant cadres handling and using medical oxygen	X	X					10.7
		Advocate for review of pre-service training curriculum to include modules on medical oxygen with relevant stakeholders			X				0.2
		Integrate the medical oxygen training curriculum into the MOH virtual academy and other approved online learning platforms			X				1.9
		Conduct training and mentorship to relevant cadres handling medical oxygen on its production, management and administration	X	X	X	X	X	X	181.6
		Conduct an assessment to establish the numbers and competencies of staff to support medical oxygen production, administration and use	X	X					2.9
6.2	Increase availability of adequate numbers of staff to support the medical oxygen ecosystem								
Thematic area		Financing for medical oxygen							
Strategic objective		Ensure adequate and sustainable financing for the production, storage, distribution, capacity building and maintenance of medical oxygen and related devices at all levels of care							
7.1	Increase funds for medical oxygen production, storage, distribution, capacity building and maintenance of medical oxygen and related devices at all levels of care	Develop a business case for medical oxygen ecosystem		X	X				7.9
		Conduct periodic targeted engagements with decision makers focusing on inclusion of medical oxygen agenda in the budget and other planning processes			X	X	X		33.8
		Conduct forecasting and quantification for medical oxygen needs at national and sub-national levels	X	X	X	X	X	X	9.2

Strategic interventions		Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn, KES)
		Scale up tools used to track medical oxygen utilization in health facilities	X	X					41.5
		Develop a tool for costing and billing for medical oxygen	X	X	X				2.2
8	Service delivery and quality assurance								
	Strategic objective	Strengthen equitable access and quality management for medical oxygen							
8.1	Institute mechanisms to ensure quality of medical oxygen from point of production to the point of use	Conduct quarterly routine support supervision to ensure compliance to medical oxygen guidelines		X	X	X	X	X	17.3
		Conduct routine sampling of medical oxygen to determine purity levels	X	X	X	X	X	X	0
		Develop clinical protocols for the appropriate administration and monitoring of medical oxygen in the management of health conditions	X	X	X				16.6
		Sensitize health workers on surveillance and reporting of adverse events related to medical oxygen use	X	X	X	X	X	X	53.8
		Establish regional calibration centers of excellence for medical oxygen devices and equipment		X	X	X	X		192.1
8.2	Improve equitable access to medical oxygen through efficient distribution systems	Assess the availability of medical oxygen infrastructure by geographic distribution, partner support, and disease burden	X	X	X	X	X	X	0
9	Monitoring, evaluation and operational research								
	Strategic objective	Enhance monitoring, evaluation, and research to improve the quality, production, and regulatory adherence in the use of medical oxygen							
9.1	Strengthen monitoring and evaluation in the medical oxygen ecosystem	Develop and implement a digital system for monitoring and auditing medical oxygen use in health facilities		X	X	X	X	X	203.8

Strategic Interventions	Activities	2025	2026	2027	2028	2029	2030	Est. cost (Mn. KES)
9.2 Enhance research and learning around medical oxygen in Kenya	Conduct a baseline assessment on the status of medical oxygen in the country	X						17
	Conduct mid-term evaluation of the Roadmap			X	X			32.7
	Conduct end-term evaluation of the Roadmap					X	X	37.4
	Conduct data quality audits on medical oxygen data in KHIS	X	X	X	X	X	X	99
	Develop a medical oxygen ecosystem support supervision checklist	X	X					3.8
	Conduct operational research on medical oxygen use and outcomes	X	X	X	X	X	X	18.2
	Establish a repository for medical oxygen research and policy documents			X	X			3.2
	Disseminate research findings on medical oxygen -conferences, policy briefs, journal articles		X		X		X	209.9

ANNEX 2: MONITORING AND EVALUATION MATRIX

Monitoring and evaluation of the Kenya Medical Oxygen Roadmap

This table summarizes the outputs, output indicators, their targets, the respective data sources and the institutions responsible for the activities.

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible	
Thematic area	Governance, management and coordination						
Strategic objective	Strengthen governance, coordination and management of the medical oxygen ecosystem						
1.1	Enhance governance mechanisms for medical oxygen at national and county level	Hold quarterly meetings with the medical oxygen partners coalition	Four quarterly medical oxygen partners coalition meetings held	Number of medical oxygen coalition meetings	Four meetings	Meeting minutes	MOH-DHPT
1.2	Enhance inter/intra sectoral collaboration and partnerships on medical oxygen	Integrate medical oxygen as an agenda in the HPT-ICCs	Medical oxygen is integrated as a standing agenda in the HPT-ICC	Number of HPT-ICC meetings where medical oxygen is an agenda	Four meetings	Minutes of meetings	MOH-DHPT
		Develop a framework to guide MOUs at county level for medical oxygen systems	Medical oxygen MOU framework developed	Number of medical oxygen MOU frameworks developed	One framework	MOH Repository	MOH-DHPT
		Appoint a medical oxygen focal person at county	Medical oxygen focal person appointed	Proportion of counties with medical oxygen focal persons	100percent	County Reports	Counties
1.3	Strengthen coordination with relevant stakeholders	Incorporate medical oxygen related activities into County Annual Workplans	Medical oxygen incorporated into County Annual workplans	Proportion of counties where medical oxygen is incorporated into Annual Work Plans	100percent	County Reports	Counties
		Map medical oxygen stakeholders at national and county levels	Medical oxygen stakeholders at national and county levels mapped	Number of stakeholder mapping databases developed	One database	MOH Repository	MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
	Review and include medical oxygen in the MOH Emergency HPT list	MOH Emergency HPT list reviewed to include Medical Oxygen	Number of MOH Emergency HPT lists reviewed to include Medical Oxygen	One reviewed MOH Emergency HPT list	Reports	MOH, partners
	Disseminate the Kenya Medical Oxygen Roadmap	The Kenya Medical Oxygen Roadmap disseminated	Proportion of counties where the Kenya Medical Oxygen Roadmap has been disseminated	100percent	Dissemination Reports	MOH-DHPT
	Conduct community-based educational campaigns to raise awareness about the safety and benefits of medical oxygen therapy	Awareness campaigns on the safety and benefits of medical oxygen therapy conducted	Number of awareness campaigns on the safety and benefits of medical oxygen therapy conducted	100percent	County Reports	MOH-DHPT
2 Regulations, guidelines and policies						
2.1 Thematic area						
Strategic objective	Strengthen the implementation and adherence to medical oxygen policies, guidelines, and regulations					
Improve end-to-end management of medical oxygen	Develop training materials on the regulation of medical oxygen, oxygen devices, and oxygen quality- customized GMPs for hospitals and manufacturers producing oxygen	Training materials on the regulation of medical oxygen, oxygen devices, and oxygen quality- developed	Number of training materials on the regulation of medical oxygen, oxygen devices, and oxygen quality developed	One set of training materials developed	MOH Repository	MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
	Train health workers at county and health facilities on the management of medical oxygen, oxygen devices and quality assurance	Health workers at county and health facilities trained on the management of medical oxygen, oxygen devices and quality assurance	Number of health workers at county and health facilities trained on the management of medical oxygen, oxygen devices and quality assurance	TBD	County Training Reports	Counties
	Develop SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure	SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure developed	Number of SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure developed	Two SOPs (installation, maintenance and repair)	MOH Repository	MOH-DHPT
	Disseminate SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure	SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure disseminated	Proportion of Counties where SOPs on installation, maintenance and repair of medical oxygen systems and related infrastructure have been disseminated	100percent	MOH Repository	MOH-DHPT
Thematic area	Systems for production, storage, transport, distribution and delivery of medical oxygen					
Strategic objective	Enhance safe production, distribution, transport, handling and use of medical oxygen					
Strengthen the safe and efficient transportation of medical oxygen	Install optimal piping and/or manifold infrastructure in public health facilities as per guidelines	Piping and manifold infrastructure installed as per the guidelines	Number of public health facilities with piping and manifold infrastructure installed as per the guidelines	TBD	County Reports	Counties

3

3.1

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
	Procure medical oxygen delivery devices for public health facilities	Medical oxygen delivery devices procured for public health facilities	Proportion of counties procuring medical oxygen delivery devices as per their Procurement Plans	100percent	County Reports	Counties
	Train health workers (Technicians and Engineers) on transportation, storage and handling of medical oxygen	Training on transportation, storage and handling of medical oxygen conducted	Number of health workers trained on transportation, storage and handling of medical oxygen	TBD	County Reports	Counties
	Conduct safety simulations/drill exercises for the transportation, storage and handling of oxygen	Safety simulations/drill exercises on transportation, storage and handling of oxygen conducted	Proportion of health facilities where simulations/drill exercises for transportation, storage and handling of medical oxygen have been conducted	TBD	County Reports	Counties
Thematic area						
Strategic objective						
Management and maintenance of medical oxygen infrastructure						
Avail appropriate infrastructure for medical oxygen generation, distribution, and storage at different levels of care						
Use evidence to inform investments in medical oxygen infrastructure	Conduct a needs assessment for medical oxygen infrastructure to inform decision making	A needs assessment for medical oxygen infrastructure conducted	Number of needs assessments on medical oxygen infrastructure	1	Survey/MOH Repository	MOH-DHPT
	Develop guidelines for hospital building plans that incorporate medical oxygen infrastructure	Guidelines incorporating medical oxygen infrastructure in hospital building plans developed	Number of guidelines incorporating medical oxygen infrastructure in hospital building plans	1	MOH Repository	MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
4.2	Develop standard guidelines for PPM tool kit by facility level	Guidelines for PPM tool kit by facility level developed	Number of PPM tool kits by facility level	1	MOH Repository	MOH-DHPT
	Equip medical engineering workshops as per the PPM tool kit guidelines	Medical engineering workshops equipped as per the PPM tool kit guidelines	Proportion of health facilities with well-equipped workshops	100percent	Survey/MOH Repository	MOH-DHPT
	Conduct periodic inventory update for oxygen therapy medical devices for diagnostics, monitoring and administration of medical oxygen	Inventory update for oxygen therapy medical devices for diagnostics, monitoring and administration of medical oxygen updated	Number of updated inventories of oxygen therapy medical devices for diagnostics, monitoring and administration of medical oxygen	1	MOH Repository	Counties HPTUs
	Support procurement of devices, accessories and spare parts for oxygen related equipment	Spares and parts for servicing equipment procured	Percentage of facilities procuring spares and parts as per the inventory assessment	100percent	Survey/MOH Repository	MOH-DHPT
5	Service the medical oxygen equipment and infrastructure as per the schedule	Medical oxygen equipment and infrastructure serviced as per the schedule	Percentage of health facilities with medical oxygen and infrastructure equipment serviced as per the schedule	100percent	Survey/MOH Repository	MOH-DHPT
Thematic area Accessories, devices and equipment for medical oxygen therapy						
Strategic objective Ensure availability and management of respiratory care accessories, devices and equipment for the safe administration of medical oxygen						
5.1	Increase availability of respiratory care accessories, devices and equipment	Conduct an assessment on availability of respiratory care	An assessment on availability of respiratory care accessories,	Number of assessments on availability of respiratory care	1	MOH Repository
						MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
5.2 Improve management of respiratory care accessories, devices and equipment	accessories, devices and equipment	devices and equipment conducted	accessories, devices and equipment			Counties
	Support procurement of respiratory care accessories, devices and equipment to ensure continuity of services	Respiratory care accessories, devices and equipment procured	Percentage of facilities with tracer Respiratory care accessories, devices and equipment	100percent	MOH Repository	
	Develop a digital inventory for all respiratory devices for proper management	A digital inventory for oxygen respiratory devices developed	Number of digital inventory for oxygen respiratory devices developed	1	MOH Repository	Public health facilities
	Conduct periodic updates to the digital inventory tool	Digital inventory tool on respiratory devices periodically updated	Number of Digital inventory tools on respiratory devices periodically updated	1	MOH Repository	MOH-DHPT
	Develop SOPs for disinfection, reuse, decommissioning and disposal of devices for medical oxygen	SOPs for disinfection, reuse, decommissioning and disposal of devices for medical oxygen developed	Number of SOPs developed	1	MOH Repository	MOH-DHPT
	Disseminate SOPs relevant to management of medical oxygen	SOPs relevant to management of medical oxygen disseminated	Number of dissemination fora for SOPs on management of medical oxygen	TBD	MOH Repository	MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
Staff						
Thematic area						
Strategic objective						
6	Enhance skills and competencies on medical oxygen for in service staff	Develop a training curriculum, training materials and job aids for in-service training for all relevant cadres handling and using medical oxygen	A training curriculum, training materials and job aids for in-service training for all relevant cadres handling and using medical oxygen developed	1) Number of training curriculums developed 2) Number of training materials developed 3) Number of job aids for in-service training developed	TBD	MOH-DHPT
		Advocate for review of pre-service training curriculum to include modules on medical oxygen with relevant stakeholders	Advocacy meetings with relevant stakeholders conducted	Number of advocacy meetings	TBD	MOH-DHPT
		Integrate the medical oxygen training curriculum into the MOH virtual academy and other approved online learning platforms	Medical oxygen training curriculum integrated into the MOH virtual academy and other approved online learning platforms	Number of approved online learning platforms where medical oxygen training curriculum has been integrated	TBD	MOH-DHPT
		Conduct trainings and mentorship to relevant cadres handling medical oxygen on its production, management and administration	Training and mentorship of relevant cadres on handling medical oxygen conducted	Number of staff trained on handling medical oxygen	TBD	MOH-DHPT
		Conduct an assessment to establish the numbers and competencies of staff to support medical ecosystem	Assessment to establish the numbers and competencies of staff conducted	Number of assessments done to establish the numbers and competencies of staff	1	MOH-DHPT
6.2	Increase availability of adequate numbers of staff to support medical oxygen ecosystem					

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
	oxygen production, administration and use					
Thematic area Financing for medical oxygen						
Strategic objective Ensure adequate and sustainable financing for production, storage, distribution, capacity building and maintenance of medical oxygen and related devices at all levels of care						
7 7.1 Increase funds for medical oxygen production, storage, distribution, capacity building and maintenance of medical oxygen and related devices at all levels of care	Develop a business case for medical oxygen ecosystem	Business case for medical oxygen ecosystem developed	Number of Business cases for medical oxygen ecosystem	1	MOH Repository	MOH-DHPT
	Conduct periodic targeted engagements with decision makers focusing on inclusion of medical oxygen agenda in the budget and other planning processes	Targeted engagements with decision makers focusing on inclusion of medical oxygen agenda in the budget and other planning processes conducted	Number of engagement meetings with decision makers focusing on inclusion of medical oxygen agenda in the budget and other planning processes	TBD	County annual budgets, Auditor general report	MOH-DHPT
	Conduct forecasting and quantification for medical oxygen needs at national and sub-national levels	Forecasting and quantification for medical oxygen needs at national and sub-national levels conducted	Number of forecasting and quantification exercises	1	MOH Repository	MOH-DHPT
	Develop a tool to track medical oxygen utilization in health facilities	A tool to track medical oxygen utilization in health facilities developed	Number of tools developed to track medical oxygen utilization in health facilities	1	MOH Repository	MOH-DHPT

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
	Develop a tool for costing and billing for medical oxygen	Tool for costing and billing for medical oxygen developed	Number of tools developed for costing and billing for medical oxygen	1	MOH Repository	MOH-DHPT
Thematic area						
Service delivery and quality assurance						
Strategic objective						
Institute mechanisms to ensure quality of medical oxygen from point of production to the point of use	Conduct quarterly routine support supervision to ensure compliance to medical oxygen guidelines	Routine support supervision to ensure compliance to medical oxygen guidelines conducted	Number of routine support supervision exercises conducted	Four (4) quarterly support supervision per year	County Reports	Counties
	Conduct routine sampling of medical oxygen to determine purity levels	Routine sampling of medical oxygen to determine purity levels conducted	Number of routine samplings for medical oxygen purity levels conducted	TBD	County Reports	Counties
	Develop clinical protocols for the appropriate administration and monitoring of medical oxygen in the management of health conditions	Clinical protocols for appropriate administration and monitoring of medical oxygen developed	Number of clinical protocols for appropriate administration and monitoring of medical oxygen developed	1	MOH Repository	MOH-DHPT
	Sensitize healthcare workers on surveillance and reporting of adverse events related to medical oxygen use	Surveillance on adverse events related to medical oxygen use conducted	Number of adverse events related to medical oxygen use	N/A	MOH PPB	Counties
	Establish regional calibration centers of excellence for medical	Regional calibration centers of excellence for medical oxygen	Number of regional calibration centers of excellence for medical	10	MOH Repository	MOH-DHPT

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8.1

Strategic interventions		Activities	Output	Output Indicator	Target	Data source	Responsible	
		oxygen devices and equipment	devices and equipment established	oxygen devices and equipment				
8.2		Improve equitable access to medical oxygen through efficient distribution systems	Assess the availability of medical oxygen infrastructure by geographic distribution, partner support, and disease burden	Assessment of the availability medical oxygen infrastructure conducted	Number of reports with affirmative action to address inequitable access to medical oxygen	1	MOH Repository	MOH-DHPT
9		Thematic area Monitoring, evaluation and operational research Strategic objective Enhance monitoring, evaluation, and research to improve the quality, production, and regulatory adherence in the use of medical oxygen						
9.1		Strengthen monitoring and evaluation in the medical oxygen ecosystem	Develop and implement a digital system for monitoring and auditing medical oxygen use in health facilities	A digital system for monitoring and auditing medical oxygen use in health facilities developed	Number of digital systems for monitoring and auditing medical oxygen use in health facilities	1	MOH Repository	MOH-DHPT
		Conduct a baseline assessment on the status of medical oxygen in the country	Baseline assessment on the status of medical oxygen in the country conducted	Number of baseline assessments on the status of medical oxygen	1	MOH Repository	MOH-DHPT	
		Conduct mid-term evaluation of the Roadmap	Mid-term evaluation conducted	Number of Mid-term evaluations conducted	1	MOH Repository	MOH-DHPT	
		Conduct end-term evaluation of the Roadmap	End term evaluation conducted	Number of End term evaluations conducted	1	MOH Repository	MOH-DHPT	
		Conduct data quality audits on medical oxygen data in KHIS	Data quality audits on medical oxygen data in KHIS conducted	Number of Data Quality Audits conducted	4 quarterly DQAs conducted annually	MOH Repository	MOH-DHPT & HIS	

Strategic interventions	Activities	Output	Output Indicator	Target	Data source	Responsible
9.2 Enhance research and learning around medical oxygen in Kenya	Develop a medical oxygen ecosystem support supervision checklist	A support supervision checklist for medical oxygen ecosystem developed	Number of supervision checklists developed	1 standard supervision checklist	MOH repository	MOH-DHPT & HIS
	Conduct operational research on medical oxygen use and outcomes	Operational research on medical oxygen use and outcomes conducted	Number of medical oxygen research-related technical documents developed - reports, conference papers, policy briefs, journal articles etc.	2	MOH repository	MOH-DHPT
	Establish a repository for medical oxygen research and policy documents	A repository for medical oxygen research and policy documents established	Number of repositories established	1 repository	MOH repository	MOH-DHPT
	Disseminate research findings on medical oxygen -conferences, policy briefs, journal articles	Research findings on medical oxygen disseminated	Number of dissemination forums held	TBD	MOH repository	MOH-DHPT

9.2



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