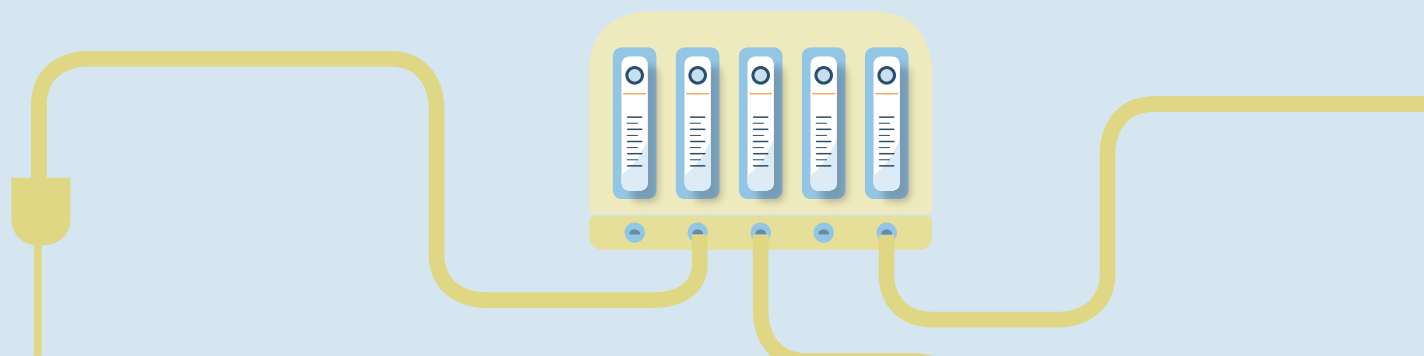


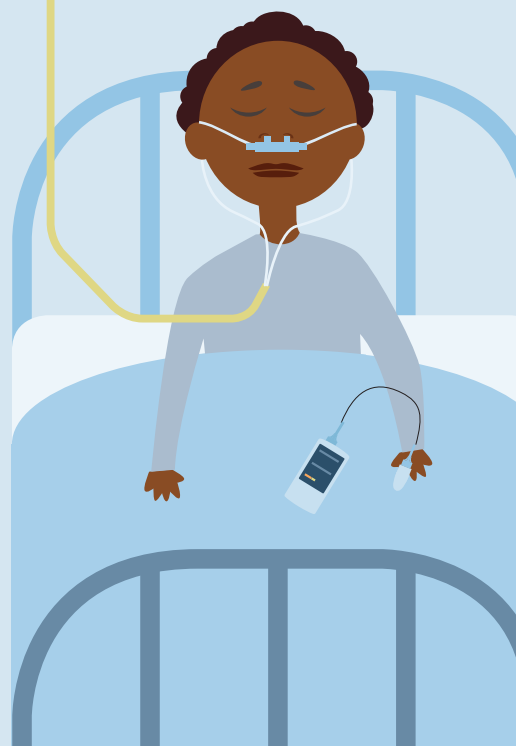
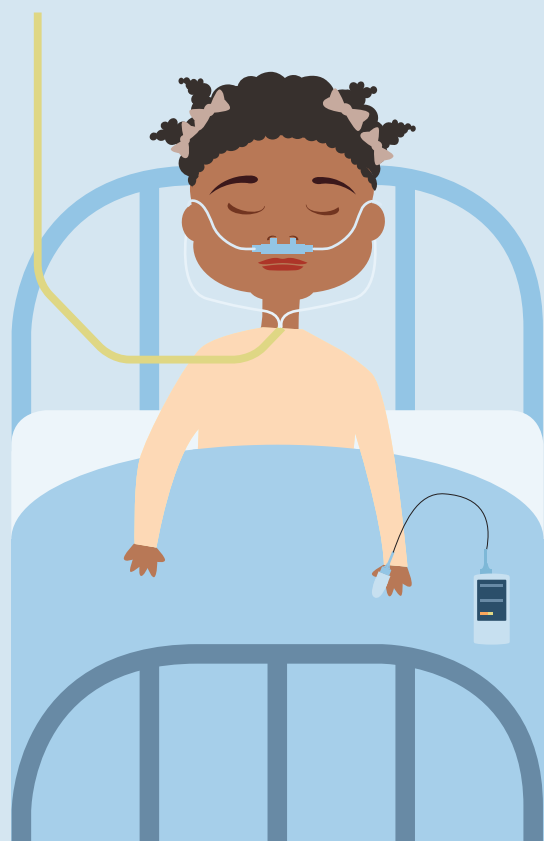
This resource has been developed for

ADVOCATES
DECISION-MAKERS



OXYGEN IS ESSENTIAL

A POLICY AND
ADVOCACY PRIMER



OXYGEN IS ESSENTIAL: A POLICY AND ADVOCACY PRIMER

Preventable deaths occur every day from hypoxemia—a severe lack of oxygen in the blood. Hypoxemia is caused by a range of common conditions—including pneumonia and complications from pregnancy and premature birth—and can be reversed by treatment with oxygen therapy. However, many health facilities in low- and middle-income countries lack functioning oxygen delivery systems.

Scaling up access to oxygen is one of the most effective, and critical, actions that decision-makers can take to improve health outcomes, particularly for vulnerable populations such as newborns, children, and pregnant women. Despite the urgent need, however, this issue is not always prioritized at the national and subnational levels. The reasons for this are many—including limited data, perceptions about costs, a lack of understanding of the impact on health outcomes, and the complexity of integration across the health system.

This primer helps advocates and decision-makers understand the need for strengthening oxygen delivery systems and how it can be done—even with limited resources. It provides resources intended to help advocates and decision-makers understand the planning, policies, and technologies involved in oxygen delivery scale-up. It showcases a successful example of oxygen policy planning from Ethiopia, and provides guiding questions for decision-makers considering a national or subnational scale-up effort of their own. A messaging map, including a compilation of key messages, provides the most effective talking points about the need for oxygen and how to increase access to this essential treatment.

WHO IS THIS PRIMER FOR?



ADVOCATES

Anyone aiming to increase access to oxygen delivery systems by influencing decision-makers to act in support of this goal. Advocates can include civil society representatives, technical experts, academia, community members, religious and community leaders, and members of the media, among others. Decision-makers are also important advocates.



DECISION-MAKERS

People with the authority to make improved access to oxygen delivery systems a reality through supportive policymaking and implementation—including funding, regulations, and laws. This might include officials from the ministry of health or finance, parliamentarians, regional health leaders, or district health committee members, among others.

HOW TO USE THIS PRIMER:

- These materials are useful for anyone who wants to learn more about oxygen delivery systems, and advocate and communicate about scaling up access to oxygen.
- Color coding throughout the primer indicates the primary target audience: **ADVOCATES**, **DECISION-MAKERS**, or both.
- Additional resources and helpful links are included along with each material, noted in the sidebar.
- The resources provided within the primer can be used together, or separately, as needed.

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KEY TERMS USED IN THIS PRIMER

For the purposes of this primer, the key terms are defined as follows:

Hypoxemia: A low level of oxygen in the blood (i.e., low blood oxygen saturation).

Medical oxygen supplies: Gas or liquid cylinders, concentrators, generators, and medical oxygen supply plants.

Oxygen delivery: Provision of oxygen therapy in a safe and effective way and using appropriate oxygen technologies and supplies, including pulse oximetry, to maintain targeted blood oxygen saturation levels.

Oxygen delivery systems: Oxygen technologies and supplies and the additional infrastructure or health system requirements necessary for successful oxygen delivery, including solar and power generators, consumables, accessories, human resources, training, maintenance, supervision, and supply chain systems.

Oxygen technologies and supplies:

The assortment of oxygen delivery products that may be necessary for administering oxygen therapy, including medical oxygen supplies, pulse oximetry, continuous positive airway pressure (CPAP) devices, mechanical ventilators, humidifiers, and air-oxygen blenders, among others.

Oxygen therapy (or supplemental oxygen):

Use of oxygen medical gas for the management of a wide variety of conditions, including many that result in hypoxemia.

ACKNOWLEDGMENTS

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OXYGEN IS ESSENTIAL: AN ISSUE BRIEF

Everyone needs oxygen to survive. But many of the most vulnerable patients in low- and middle-income countries—including newborns, children, and pregnant women—do not receive the oxygen therapy that could save their lives.

Oxygen therapy is required to treat hypoxemia, a low level of oxygen in the blood. Hypoxemia affects millions of people each year suffering from a range of common conditions—including childhood pneumonia, newborn conditions, and obstetric emergencies. Oxygen therapy can also be critical for patients with noncommunicable diseases, such as asthma and heart failure, and during pandemic disease outbreaks. When severe hypoxemia is not quickly diagnosed and addressed, it can lead to death.

However, many health facilities across low- and middle-income countries (LMIC) face a severe shortage of oxygen. In fact, nearly half of hospitals in LMIC have inconsistent or no oxygen supply, and only half have functional

pulse oximeters. When resources are limited, there can be competition for access to oxygen among the various wards of a health facility, such as surgical, pediatric, and neonatal.

Pulse oximeters diagnose hypoxemia by measuring the amount of oxygen in the blood. They are used to help health workers know who needs oxygen and how much oxygen to give.

Oxygen therapy, paired with pulse oximetry, should be available in all wards of health facilities. This requires investment in strengthening the oxygen delivery systems, including supply management and provider training. Scaling up access to oxygen delivery could save hundreds of thousands of lives each year.

KEY POINTS

- Oxygen therapy is **critical for those suffering from low oxygen levels**—including many newborns, children, and pregnant women.
- **Access to oxygen delivery systems is inadequate** in health facilities across low- and middle- income countries
- Oxygen therapy paired with pulse oximetry **is a worthwhile investment**
- Oxygen delivery should be **included in national and subnational health budgets** and integrated into maternal, newborn, and child health policies and programs



Oxygen saves lives.

Hypoxemia disproportionately affects the most vulnerable: newborns, children, and pregnant women.

More than half of all neonatal deaths globally are due to severe respiratory distress syndrome (a complication of preterm birth), neonatal pneumonia and sepsis, and intrapartum-related conditions or asphyxia—all of which can cause dangerously low blood oxygen levels. Global estimates suggest that one in five sick newborns has hypoxemia upon admission to a hospital. Administering oxygen therapy, antibiotics, and other supportive care practices for severe neonatal infections could save the lives of more than 400,000 babies each year.

Pneumonia is the world's leading infectious cause of death in children younger than five years, and at least 13 percent of children admitted to a hospital with severe pneumonia have hypoxemia. Improved oxygen delivery systems could reduce childhood pneumonia-related mortality by at least 35 percent in high-burden, low-resource settings.

For women giving birth in LMIC, obstetric emergencies related to hypoxemia—including hemorrhage, pulmonary embolism, and eclampsia—are common and hypoxemia often goes undiagnosed. In fact, 15 percent of all pregnant women develop a potentially life-threatening complication. Making oxygen with pulse oximetry available in all maternity facilities could promptly identify hypoxemia and help prevent many of these conditions from taking women's lives.

Oxygen with pulse oximetry is recommended globally.

Oxygen is considered an essential medicine by the World Health Organization (WHO) and has been included in its Model List of Essential Medicines under general anesthetics for nearly 40 years. In 2017, WHO expanded oxygen's indication specifically for the management of hypoxemia, reflecting oxygen's critical role as an essential medicine beyond surgical settings.

WHO also published training materials and a manual for the clinical use of pulse oximetry, which should be used hand-in-hand with oxygen. Using pulse oximeters can save lives and resources by properly diagnosing the level of oxygen in the blood, guiding the amount of oxygen a patient needs, and determining when to discontinue therapy. Oxygen is an essential drug, but it must be administered correctly and received in a certain concentration to avoid injury resulting from oxygen toxicity, particularly in newborns.

Oxygen has cost benefits.

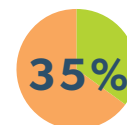
The initial costs of oxygen technologies and supplies are quickly offset by the resulting health benefits. In fact, research suggests that the cost savings of oxygen delivery systems are comparable to other interventions widely recommended to reduce mortality from pneumonia, including vaccines. Because oxygen therapy can be used to manage any form of hypoxemia regardless of its underlying cause, scaling up access to oxygen delivery systems can improve health outcomes across disease areas and populations, particularly for the most vulnerable. Understanding the oxygen needs of each health facility—including demand and financial and logistical requirements—is important to plan for a reliable and cost-effective scale-up.

Oxygen can, and should be, integrated within existing health programs and policies.

Ensuring the integration of oxygen delivery into existing health programs, especially those focused on maternal, newborn, and child health (MNCH), should be a priority for country decision-makers and global health donors. While oxygen is included in some countries' national MNCH treatment guidelines, it is still not widely used in MNCH facilities.

At the global level, in 2012 WHO, the United Nations Population Fund, and the United Nations Children's Fund included oxygen as one of the 20 most effective interventions for preventing deaths among newborns, children,

KEY STATS

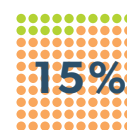


Possible **reduction** in risk of death from **childhood pneumonia** with introduction of improved oxygen delivery systems



Up to 400,000

Number of **babies' lives that could be saved** by antibiotics and supportive care practices, including warmth, fluids, and oxygen therapy



Pregnant women in LMIC who develop life-threatening complications, many of whom could be treated with oxygen therapy

and pregnant women in their “Priority life-saving medicines for women and children” list. In addition, WHO has published recommendations and guidelines for integrating oxygen delivery at various levels of the health system.

Oxygen technologies and supplies are simple, and they work in low-resource settings.

Oxygen medical gas can be dispensed through several methods (see Figure 1), including cylinders, concentrators, and pipelines. In many low-resource settings, pressurized oxygen cylinders are commonly used because they initially cost less to purchase and do not require

an electrical supply. However, they must be regularly refilled and delivered to the facility before oxygen supplies are depleted.

Oxygen concentrators draw in air from the environment to provide a reliable, inexpensive, and continuous source of oxygen for multiple patients at the same time.

Central pipeline systems are used to supply medical oxygen to multiple wards within a health facility.

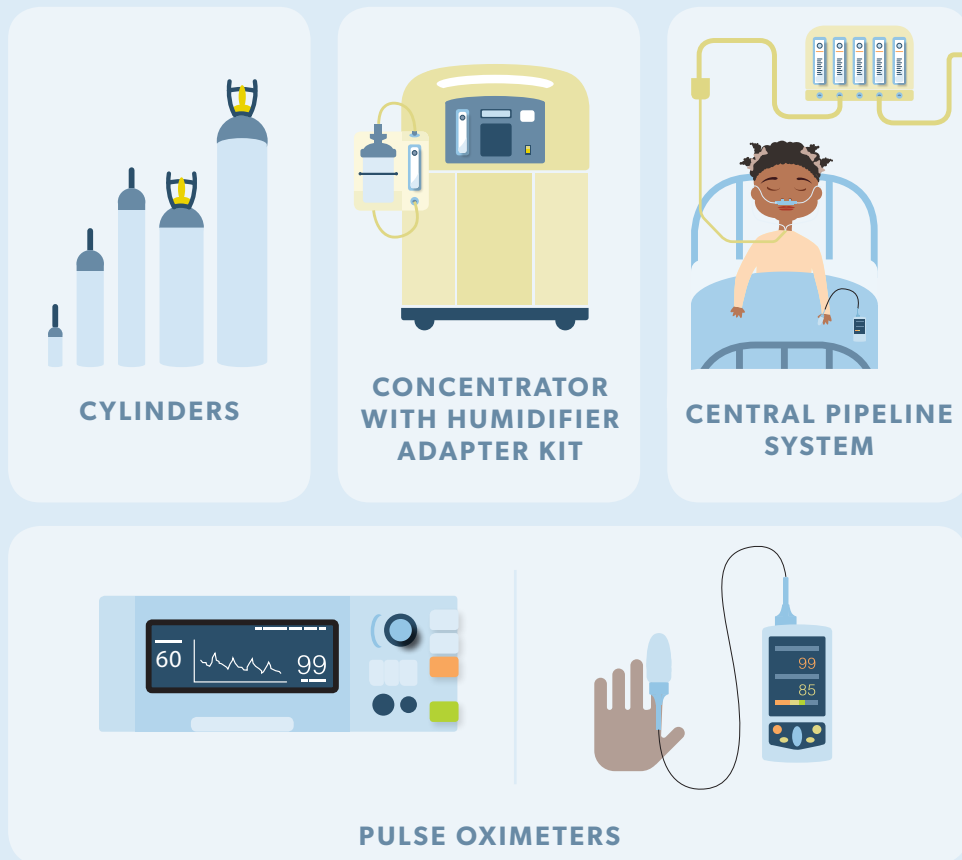
Pulse oximeters should always be used to assess patients at the time of admission and to regularly monitor the progress of patients on oxygen therapy.



Clinton Health Access Initiative

Staff at a hospital in Uganda using pulse oximetry while providing care for a child.

FIGURE 1 OXYGEN TECHNOLOGIES AND SUPPLIES



Example of oxygen technologies and supplies for decision-makers to consider when scaling up access to oxygen delivery systems.



Adara Development

Recent studies have shown that even where oxygen and pulse oximetry are available in a facility, patients may not receive oxygen therapy when needed. To be effective, management of oxygen delivery systems should be consistent

and accurate across facilities—including training, maintenance, and supervision—so that every patient receives the proper amount of oxygen therapy at the right time.

A doctor's experience with oxygen

Bernard Olayo has been practicing medicine for 17 years in Kenya. Over nearly two decades, he has seen far too many patients—including babies, children, and adults—die from lack of oxygen therapy in hospitals and clinics. Most of these patients suffered from common illnesses, such as pneumonia or complications from pregnancy and childbirth, which would not have been life threatening with proper access to oxygen.

Dr. Olayo has made it his mission to change that situation. Through an innovative public-private partnership that has provided the financing and technical expertise for a centralized oxygen plant that distributes to facilities, today every hospital in Siaya County in Western Kenya has functional oxygen—not just in operating theaters, but in pediatric and maternity wards as well. This improved access is saving lives that just a few short years ago would have been lost.

“The biggest challenge,” Olayo says, “is convincing policymakers that oxygen should be a priority. They need to understand that oxygen is an essential medicine and should be incorporated into policies and budgets. Once that happens, we can save even more lives.”

RECOMMENDATION

Oxygen delivery should be a political priority.

Oxygen therapy with pulse oximetry are lifesaving, financially worthwhile interventions that have long been neglected in many health systems. Investing in oxygen delivery systems could save countless lives in countries around the world. Integrating this simple but overlooked intervention into policies, budgets, and programs—especially those focused on newborns, children, and pregnant women—should be an urgent priority for health decision-makers in low- and middle-income countries.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

- ▶ Oxygen Is Essential: An Issue Brief
- Oxygen Is Essential: A Policy Brief
- Global Guidelines for Shaping National Oxygen Policy
- Oxygen Technologies and Supplies
- Guiding Questions for Oxygen Scale-up
- Mapping a Future for Oxygen Access for All: Ethiopia's Experience
- Oxygen Messaging Map

It is available at sites.path.org/oxygen-therapy-resources/oxygen-primer





OXYGEN IS ESSENTIAL: A POLICY BRIEF

In many low- and middle-income countries, newborns, children, and pregnant women die needlessly each year from a dangerous condition called hypoxemia, or a low concentration of oxygen in the blood. Hypoxemia can be caused by a range of illnesses and complications—including pneumonia, neonatal infections, premature birth, and obstetric emergencies.

Other conditions, such as noncommunicable diseases and pandemic disease outbreaks, can also result in hypoxemia.

Most cases of hypoxemia can be easily diagnosed and managed with functioning oxygen delivery systems, including pulse oximetry and oxygen therapy. Pulse oximeters are used to help health workers know who needs oxygen and how much oxygen to give.

Oxygen therapy is extremely limited in most low- and middle-income countries (LMIC), even though it is considered an essential medicine by the World Health Organization (WHO) and identified as one of 20 priority lifesaving treatments for newborns, children, and pregnant women. Recent studies indicate that nearly half of hospitals in low-resource settings have inconsistent or no supply of oxygen, and only half have pulse oximeters. Many health authorities assume that the costs associated with equipment purchase, maintenance, and provider training make expanding access to oxygen delivery unrealistic or unaffordable.

However, the high prevalence of serious conditions resulting in hypoxemia underscores the need to better prioritize oxygen's availability and integration in national and subnational health care systems. Expanding access to oxygen delivery can save countless lives from a wide range of conditions. Increased commitment is needed by decision-makers to include oxygen technologies and supplies in national policies, plans, and budgets.

OXYGEN: A HEALTH PRIORITY

Oxygen therapy can prevent deaths from common conditions that affect the most vulnerable in low- and middle-income countries: newborns, children, and pregnant women. For health decision-makers looking for practical ways to improve health outcomes, oxygen delivery should be a key consideration for inclusion in national and subnational policies, programs, and budgets.



Adara Development

Prioritizing oxygen delivery is one of the most effective and worthwhile investments to save the lives of newborns, children, and pregnant women suffering from hypoxemia.

IN THIS BRIEF

- **Health benefits of incorporating oxygen therapy into health systems**
- **Integration of oxygen delivery into existing policies and programs**
- **Overview of oxygen delivery systems**
- **Guiding questions on increasing access to and utilization of oxygen delivery systems**
- **What policymakers and health decision-makers can do to scale up access to oxygen delivery**

The health benefits of oxygen delivery: lives saved

Given the wide range of conditions that lead to hypoxemia, improved access to oxygen therapy and pulse oximetry can benefit all populations. However, its impact is particularly significant in improving maternal, newborn, and child health (MNCH).

Newborn health impact

More than half of all neonatal deaths globally are due to preterm birth complications, neonatal pneumonia, and neonatal sepsis.

Antibiotics with full supportive care for severe neonatal infections—which includes oxygen therapy—could prevent an estimated 400,000 neonatal deaths each year.

Child health impact

Pneumonia is the leading infectious cause of death in children younger than five years, and causes 15 percent of child deaths around the world. Approximately 13 percent of children with pneumonia develop hypoxemia; between 1.5 and 2.7 million hypoxemic pneumonia cases present to health facilities each year. If both pulse oximetry and oxygen therapy were consistently available, up to 120,000 child deaths could be averted each year in the 15 countries with the highest pneumonia burden.

Maternal health impact

Approximately 15 percent of all pregnant women develop a potentially life-threatening complication that may require emergency obstetrical intervention—including oxygen—for survival. Oxygen therapy is commonly recommended for obstetric emergencies—including hemorrhage, pulmonary embolism, eclampsia, sepsis, and heart failure. Cesarean sections represent a high proportion of the total emergency surgical and trauma care procedures in LMIC. Furthermore, availability of oxygen for pregnant women is important not only to protect maternal health, but also to help avoid intrapartum-related injury to or asphyxia in the newborn.

Integrating oxygen delivery into policies and programs

The optimal strategy for policy development takes a system-wide approach that considers not only how oxygen delivery can be incorporated into programs, but also into efforts focused on strengthening service delivery, procurement, and supply chain management. Global strategies, guidelines, and protocols provide direction on how oxygen delivery can be incorporated into existing health programs, including MNCH programs.

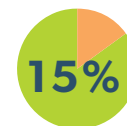
Global policies

In June 2017, WHO included a new listing for oxygen in its Model List of Essential Medicines and Model List of Essential Medicines for Children, identifying oxygen as a medicine essential for the management of hypoxemia. This change clarifies oxygen's importance as a medical treatment that should be widely available in health facilities everywhere.

In 2012, WHO, the United Nations Population Fund, and the United Nations Children's Fund selected oxygen as one of 20 medicines included in a list of priority lifesaving medicines for women and children for its impact on reducing maternal, newborn, and child morbidity and mortality. In 2015, oxygen technologies and supplies were placed in the WHO/United Nations Population Fund/United Nations Children's Fund interagency list of priority medical devices for essential interventions for reproductive, maternal, newborn, and child health.

WHO oxygen treatment protocols are provided in a number of global guidelines—including an oxygen therapy for children manual for health workers. Further directions are also integrated into guidelines for various health areas, including acute respiratory infections, neonatal conditions, chronic respiratory diseases, and emergency and essential surgical care. The 2016 WHO standards for improving the quality of maternal and newborn care in health facilities include benchmarks for availability of oxygen technologies and supplies. [See Global Guidelines for Shaping National Oxygen Policy](#)

KEY STATS



Pneumonia causes 15 percent of under-five deaths around the world



120,000

Pulse oximetry and oxygen therapy could **save up to 120,000 children's lives** each year



Up to 400,000

Antibiotics and full supportive care for severe neonatal infections—which includes oxygen therapy—**has the potential to prevent up to 400,000 neonatal deaths** each year



15 percent of pregnant women develop a complication that may require emergency intervention—including oxygen therapy

National policies

A 2016 analysis by PATH found that more than 30 percent of national essential medicines lists across 105 countries did not include oxygen at all—and roughly half listed oxygen only for anesthesia. Ensuring that oxygen is represented on a country’s essential medicines list is a critical step toward improving access to oxygen therapy. Further action is needed to ensure inclusion of oxygen delivery in national and subnational health policies that will support reliable access to oxygen delivery systems within health facilities.

Other national guidance documents that should incorporate oxygen delivery include MNCH strategies, standards of care, and operational guidelines focused on improving service delivery at the facility level. Oxygen technologies and supplies, including pulse oximeters, oxygen blenders, flowmeters, and patient interfaces, should be integrated into essential equipment lists, regulatory policies, procurement and supply chain management

guidelines, standard treatment protocols, training manuals, health facility assessments, and maintenance procedures.

Oxygen delivery systems: benefits and challenges

Oxygen is an internationally available medicine that can be dispensed through a range of delivery methods, giving decision-makers the flexibility to choose the right medical oxygen supplies for their context (see Figure 2). Research suggests that the cost benefits of oxygen therapy with pulse oximetry are comparable to other interventions that are widely recommended to reduce mortality from pneumonia, including vaccines.

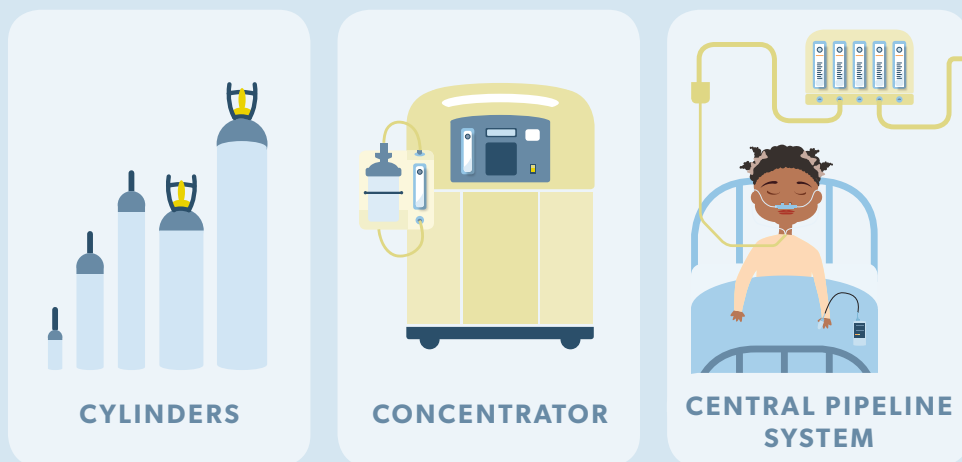
Because oxygen therapy can also be used to treat any form of hypoxemia regardless of its underlying cause, it has the potential to reduce disease burden among many patient groups. Increasing investments in oxygen delivery within the health system can impact health outcomes across all populations.



Gracian Health Systems

While cylinders do not require an electrical supply, they do require refills from a supplier, which incurs transportation costs and supply chain management considerations.

FIGURE 2 COMMON SOURCES OF OXYGEN MEDICAL GAS



Oxygen medical gas is available to health facilities in multiple formats, including cylinders, concentrators, and central pipeline systems.

Oxygen delivery systems

Multiple sources are available for supplying oxygen medical gas in health facilities. These include cylinders, concentrators, and central pipeline systems. Many decision-makers in LMIC choose pressurized oxygen cylinders over concentrators or central pipeline systems because they are initially less expensive.

While cylinders do not require an electrical supply, they do require refills, which incurs transportation costs and supply chain management considerations. Central pipeline systems require significant capital expense.

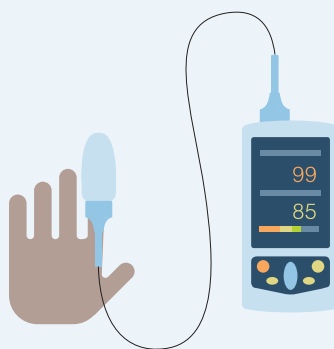
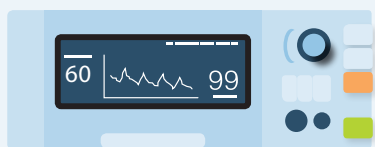
Health facilities should consider a medical oxygen supply strategy after careful evaluation of the total cost of ownership and advantages and disadvantages of the variety of oxygen delivery options. Over time, the use of cylinders may become more expensive for a facility compared to oxygen concentrators, depending on the oxygen demand and power availability. Concentrators use a power supply to

concentrate oxygen from ambient air, resulting in an inexhaustible source of oxygen for multiple patients at the same time. In Papua New Guinea, oxygen concentrators, together with pulse oximetry, a reliable power supply, regular maintenance, and training for providers, cost US\$50 per disability-adjusted life year (DALY) averted. Innovations are under way to develop oxygen concentrators that would reliably deliver oxygen therapy at low cost without relying on consistent electricity, pointing to potential future reductions in overall cost of oxygen delivery systems.

Pulse oximetry for diagnosis and management

To increase the effectiveness of oxygen delivery systems, decision-makers should scale up pulse oximetry for diagnosis of blood oxygen levels in all facilities with oxygen therapy. Pulse oximeters (see Figure 3) are simple to use and can guide decisions on how much, and for how long, oxygen therapy should be

FIGURE 3 PULSE OXIMETERS



Pulse oximeters are simple devices used to detect hypoxemia and guide decisions on how much, and for how long, oxygen therapy should be delivered. Pulse oximeters come in multiple formats, including bench-top (left) and handheld (right).

delivered. Preterm newborns are especially vulnerable to injury from too much oxygen, and monitoring with pulse oximetry is vital to avoid serious complications, such as blindness. Pulse oximetry gives health workers the confidence to administer oxygen therapy only when needed and monitor the patient to ensure the correct level of oxygen is administered.

Systems challenges

Recent studies have shown that even where oxygen and pulse oximetry are available in operating theaters, patients with hypoxemia in other wards may not be receiving oxygen

therapy when they need it. For example, a child suffering from pneumonia may need oxygen therapy in the pediatric ward, where oxygen delivery systems are not available.

Decision-makers must prioritize oxygen delivery systems that ensure technologies and supplies are available where they are needed, and used consistently and correctly—including training, maintenance, and supervision—so that every patient receives the proper amount of oxygen at the right time.

NEXT STEPS FOR SCALING UP OXYGEN DELIVERY

Prioritizing oxygen delivery is one of the most effective ways to save the lives of newborns, children, and pregnant women suffering from the range of conditions that cause hypoxemia. Expanding access to oxygen delivery systems will benefit other populations, including those suffering from noncommunicable diseases, trauma, and other disorders.

To scale up access to oxygen delivery, health policymakers and decision-makers should:

- ★ Prioritize funding for and integration of oxygen delivery in health facilities.
- ★ Incorporate oxygen and pulse oximetry into existing health policies, including national maternal, newborn, and child health strategies, treatment guidelines, and essential medicines and equipment lists.
- ★ Ensure responsible management of oxygen technologies and supplies, and strengthen health worker training and capacity for proper use and maintenance of equipment.
- ★ Gather data on oxygen, pulse oximetry, and hypoxemia indicators to increase understanding of hypoxemia burden and oxygen therapy need, which can help ensure access to oxygen delivery for the full range of indications recommended by WHO and national treatment guidelines.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

- **Oxygen Is Essential: An Issue Brief**
- ▶ **Oxygen Is Essential: A Policy Brief**
- **Global Guidelines for Shaping National Oxygen Policy**
- **Oxygen Technologies and Supplies**
- **Guiding Questions for Oxygen Scale-up**
- **Mapping a Future for Oxygen Access for All: Ethiopia's Experience**
- **Oxygen Messaging Map**

It is available at sites.path.org/oxygen-therapy-resources/oxygen-primer





GLOBAL GUIDELINES FOR SHAPING NATIONAL OXYGEN POLICY

Strategic policy development can help ensure and guide implementation of sustainable programming, budgets, and supply management. As health decision-makers plan for oxygen scale-up, incorporating oxygen delivery into national and subnational policies should be a key priority.

Oxygen delivery is a crosscutting issue and requires integration into a variety of existing national plans and programs across the health system, including those for maternal, newborn, and child health. For this purpose, the World Health Organization (WHO) has developed global guidance to equip health decision-makers, managers, and policymakers with the information and guidance they need to incorporate oxygen delivery into national planning and policy documents.




PATH/Gabe Bienrzycki

This resource provides information on four critical policy areas related to oxygen delivery:

1. Strengthening integration of oxygen delivery across national policies, plans, and guidelines.
2. Clinical recommendations for the management of hypoxemia with oxygen therapy.
3. Selection, installation, and maintenance of oxygen technologies and supplies.
4. Monitoring and evaluation of oxygen delivery systems.

Each section includes:

- Recent fundamental WHO publications that recommend or include the use of oxygen therapy for the management of hypoxemia in newborns, children, and adults.
- Why the policies are important for scale-up of oxygen delivery systems.
- The types of local plans and policies the global guidance can inform.
- The primary policy audience.

 This material can be used in conjunction with the *Oxygen Technologies and Supplies* and *Guiding Questions for Oxygen Scale-Up* resources provided in this primer.

 For a real-world description of how one country is integrating oxygen therapy into its national policies and programs, see the *Ethiopia's Experience* resource provided in this primer.

To explore additional global guidelines for oxygen therapy, please visit:

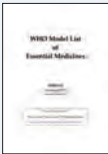
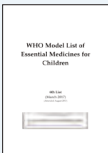

- WHO publications library—www.who.int/publications/en/
- PATH—sites.path.org/oxygen-therapy-resources/explore-global-guidelines-for-oxygen-use/

1. Strengthening integration of oxygen delivery across national policies, plans, and guidelines

The global guidance documents below are a starting point for the integration of oxygen therapy for the management of hypoxemia into national health priorities, health plans, and other overarching planning frameworks. They can inform national medicines and equipment lists, as well as strategies and implementation plans. Local guidance should be adopted and adapted at the subnational level, as relevant, to ensure alignment between national and subnational policy and practice.

GLOBAL GUIDANCE DOCUMENTS FOR STRENGTHENING INTEGRATION OF OXYGEN DELIVERY ACROSS NATIONAL POLICIES, PLANS, AND GUIDELINES

Audience: Health policymakers, health program managers, and medicines supply managers in the public and non-public health sectors.

GLOBAL GUIDANCE	DESCRIPTION
 <p>WHO Model List of Essential Medicines (EML), 2017</p>	<p>Oxygen is listed as an essential medicine for the management of hypoxemia in adults.</p>
 <p>WHO Model List of Essential Medicines for Children (EMLc), 2017</p>	<p>Oxygen is listed as an essential medicine for the management of hypoxemia in children. No more than 30% oxygen should be used to initiate resuscitation of neonates less than or equal to 32 weeks of gestation.</p>
 <p>WHO Interagency list of medical devices for essential interventions for reproductive, maternal, newborn, and child health, 2015</p>	<p>Multiple oxygen technologies and supplies are included on the global list of priority medical devices.</p>

POTENTIAL APPLICATION AT NATIONAL LEVEL

- ★ Essential medicines lists.
- ★ Priority medical devices lists.
- ★ Health policies, health strategies, implementation plans, and budgets across the health system.

2. Clinical recommendations for the management of hypoxemia with oxygen therapy

The global standard treatment guidelines and provider training materials listed below provide information and protocols for the clinical diagnosis, monitoring, and safe administration of oxygen therapy across different populations—including newborns, children, and adults. These documents relay the best practices for management of patients with hypoxemia, including the coordinated use of pulse oximetry for oxygen delivery and monitoring.

GLOBAL GUIDANCE DOCUMENTS FOR THE CLINICAL MANAGEMENT OF HYPOXEMIA IN NEWBORNS, CHILDREN, AND ADULTS

Audience: Health care providers, policymakers, biomedical engineers, program managers, health facility administrators, and paramedical professional staff involved in the care of patients.

GLOBAL GUIDANCE	DESCRIPTION
 <p>WHO Oxygen therapy for children: a manual for health workers, 2016</p>	Details the following areas: appropriate detection of hypoxemia; use of pulse oximetry; availability and clinical use of oxygen therapy; monitoring of pediatric patients on oxygen therapy.
 <p>WHO Paediatric emergency triage, assessment and treatment: care of critically-ill children: updated guidelines, 2016</p>	Provides recommendations on when to start and stop oxygen therapy and appropriate oxygen flow rates and humidification for severely ill children.
 <p>WHO Standards for improving quality of maternal and newborn care in health facilities, 2016</p>	Specifies quality measures on safe oxygen therapy for the routine care and management of complications for women and their babies during labor, childbirth, and the early postnatal period.
 <p>WHO e-Pocket book of hospital care for children, 2016; based on the Pocket book of hospital care for children (2nd edition), 2013</p>	Provides up-to-date, evidence-based clinical guidelines, including how to give oxygen, for children requiring hospital care.
 <p>WHO Recommendations on interventions to improve preterm birth outcomes, 2015</p>	Provides recommendations on the provision of oxygen therapy for preterm newborns, including guidance on the unique concentrations required for this population.

POTENTIAL APPLICATION AT NATIONAL LEVEL

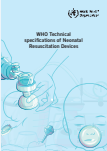

- ★ Standard treatment guidelines.
- ★ Provider training materials, including training curricula and job aids.
- ★ Health care worker policies.
- ★ Service delivery and quality of care standards.
- ★ Health care worker accreditation requirements.

3. Selection, installation, and maintenance of oxygen technologies and supplies

The global guidelines below help inform the selection, quality, and implementation of oxygen technologies and supplies in LMIC. These policies include technical information—such as minimum performance requirements and other considerations for medical device management—to ensure sustainable, effective implementation of oxygen delivery in health facilities.

GLOBAL GUIDANCE DOCUMENTS FOR OXYGEN TECHNOLOGIES AND SUPPLIES

Audience: Health facility administrators, policymakers, program managers, hospital personnel, regulatory and procurement officers, logisticians and biomedical/clinical engineers in facilities, and manufacturers with the responsibility of planning and supplying local, national, or international oxygen delivery systems.

GLOBAL GUIDANCE	DESCRIPTION
 <p>WHO Technical specifications of neonatal resuscitation devices, 2016</p>	Provides a minimum standard baseline to select and procure high-quality, affordable, accessible, and appropriate neonatal resuscitation devices.
 <p>WHO Technical specifications for oxygen concentrators, 2015</p>	Issues guidance on the appropriate selection, procurement, utilization, and maintenance of oxygen concentrators.

POTENTIAL APPLICATION AT NATIONAL LEVEL

- ★ Regulations affecting registration and importation of medical devices.
- ★ Medical device technical specifications and standards.
- ★ Guidelines on medical equipment management and maintenance.

4. Monitoring and evaluation of oxygen delivery systems

Measurement and evaluation of oxygen delivery systems are critical to identify challenges and ensure sustainability. Several global tools help inform national understanding of the supply of oxygen and pulse oximetry, and how oxygen delivery is incorporated into the health system. Routine surveillance should include indicators on availability and functionality of oxygen technologies and supplies as well as consumption or actual use of oxygen therapy.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

- Oxygen Is Essential: An Issue Brief
- Oxygen Is Essential: A Policy Brief
- ▶ Global Guidelines for Shaping National Oxygen Policy
- Oxygen Technologies and Supplies
- Guiding Questions for Oxygen Scale-up
- Mapping a Future for Oxygen Access for All: Ethiopia's Experience
- Oxygen Messaging Map


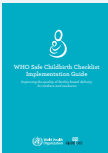



It is available at sites.path.org/oxygen-therapy-resources/oxygen-primer



For more information and additional resources, please visit sites.path.org/oxygen-therapy-resources

GLOBAL GUIDANCE DOCUMENTS FOR MONITORING OXYGEN DELIVERY SYSTEMS

Audience: Government officials, local and national administrative staff, policymakers, planners, and program managers.

GLOBAL GUIDANCE	DESCRIPTION
 <p>WHO Service Availability and Readiness Assessment (SARA), 2015</p>	Includes oxygen technologies and supplies as indicators to assess and monitor service availability and readiness of health facilities.
 <p>WHO Safe birth checklist implementation guide: improving the quality of facility-based delivery for mothers and newborns, 2015</p>	Includes an assessment of the availability of oxygen cylinders/concentrators in delivery rooms for the care of mothers and babies during childbirth.
 <p>WHO Needs assessment for medical devices, 2011</p>	Provides guidance on the methodological approach, as well as tools and resources, to conduct a needs assessment for medical devices.
 <p>WHO Health technology assessment of medical devices, 2011</p>	Provides guidance on health technology assessment of medical devices for evidence-informed and context-based decision-making.
 <p>WHO Essential Surgical Care (IMEESC) toolkit: tool for situational analysis to assess emergency and essential surgical care, 2009</p>	Includes an assessment of oxygen supply, adult and pediatric pulse oximeters, and other oxygen technologies and supplies in Level 1, 2, and 3 health facilities.

POTENTIAL APPLICATION AT NATIONAL LEVEL

National data surveillance instruments such as:

- ★ Health Management Information Survey (HMIS).
- ★ Demographic and Health Survey (DHS).
- ★ Service Availability Mapping (SAM).
- ★ Health Service Provision Assessment (SPA).
- ★ Health Facility Assessment (HFA).

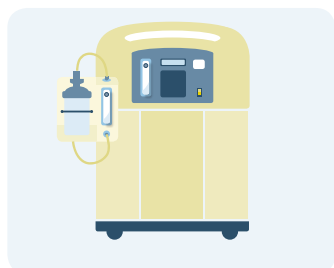


OXYGEN TECHNOLOGIES AND SUPPLIES

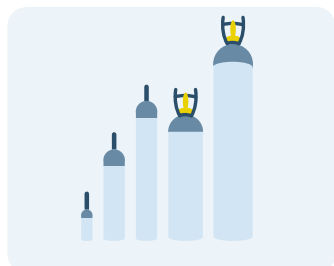
This resource is intended to help decision-makers understand the variety of products available to deliver and monitor oxygen therapy in health facilities, as well as the role of technical specifications in the procurement and provision of oxygen technologies and supplies.

Technologies and supplies for oxygen delivery

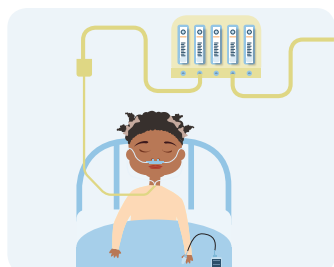
OXYGEN MEDICAL GAS



- **Oxygen concentrators** draw air from the environment to provide a continuous supply of concentrated oxygen. They require a consistent supply of electricity and routine maintenance. When power supplies are inadequate or susceptible to voltage fluctuations, power stabilizers or uninterruptible power supply may be needed.




- **Oxygen cylinders or tanks** contain set amounts of liquid or pressured gas. They require continuous refills and are thus most useful where central refilling and transportation infrastructure are reliable and affordable.



- **A central oxygen, or pipeline, system** uses pipes to provide oxygen to various locations within a health facility. These systems are typically economical in large hospitals that require a high volume of oxygen and can support the costs of the centralized pipeline infrastructure.

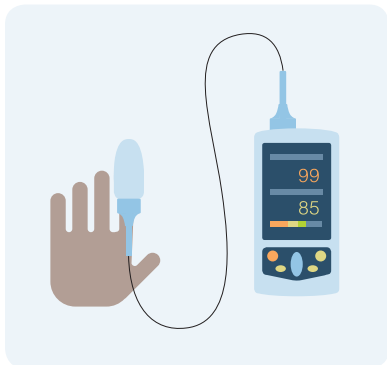


A handheld pulse oximeter being used to detect hypoxemia in a child at a hospital in Uganda.

 This material can be used in conjunction with the *Global Guidelines for Shaping National Oxygen Policy and Guiding Questions for Oxygen Scale-Up* resources provided in this primer.

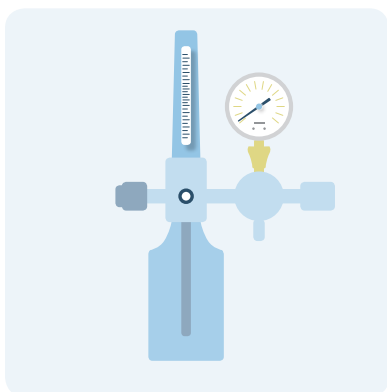
A comparison of oxygen concentrators, oxygen cylinders, and central oxygen (pipeline) systems is available in the World Health Organization technical specifications for oxygen concentrators—apps.who.int/medicinedocs/documents/s22194en/s22194en.pdf—page 7

PULSE OXIMETRY



Pulse oximetry is a simple, noninvasive device used to measure the oxygen level (oxygen saturation) of blood. The standard of care for detecting hypoxemia, pulse oximetry should be used to determine the need for oxygen therapy, and to closely monitor the required concentration of oxygen.

ACCESSORIES



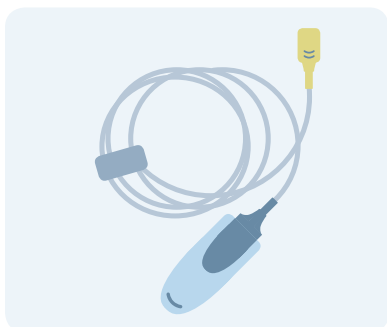
Accessories, such as flowmeters, flow splitters, and oxygen blenders, are used to adjust the flow rate and concentration of oxygen therapy. They are used to prevent the risk of improperly delivered oxygen therapy, especially for newborns, and to allow multiple patients to be treated at the same time. During high-flow oxygen therapy, oxygen humidifiers may be required. Pressure regulators and gauges are accessories required for oxygen cylinders.

CONSUMABLES



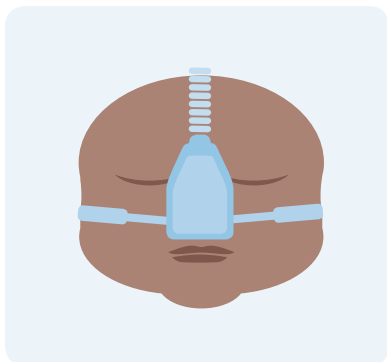
Consumables, including airway interfaces such as nasal cannula and oxygen tubing, should be appropriately sized and are intended for single use to deliver oxygen to the patient. Nasal prongs are the preferred method for delivering oxygen to infants and children younger than five years.

SPARE AND REPLACEMENT PARTS



Spare and replacement parts, such as probes and batteries for pulse oximeters and internal filters for oxygen concentrators, are key to proper maintenance. They can vary in design and life expectancy, require regular replacement, and usually are not interchangeable between different brands and models.

ADDITIONAL RESPIRATORY DEVICES



Additional respiratory devices, such as continuous positive airway pressure devices, resuscitation devices, mechanical ventilators, and anesthesia machines, may be needed during oxygen therapy for certain medical applications, and the appropriate clinical guidelines should be referenced.

OXYGEN ANALYZING SYSTEMS



Oxygen analyzing systems are instruments that measure the flow rate, oxygen concentration, and outlet pressure from oxygen technologies, verifying the devices are functioning properly and signaling when maintenance is needed. They should be used to periodically monitor the performance of oxygen technologies.

Technical specifications for oxygen technologies and supplies

Given the wide range of technologies and supplies needed for safe, high-quality oxygen delivery, technical specifications provide critical guidance for the appropriate selection, procurement, utilization, maintenance, and decommissioning of oxygen technologies and supplies. Decision-makers may wish to update or develop local technical specifications for oxygen technologies and supplies. These guidance documents should be evidence-based, reflective of the local landscape as well as international standards, and easily understood by a range of stakeholders—including supply managers, health facility administrators, biomedical engineers, and health care providers. Table 1 provides useful considerations for the development or updating of local oxygen-specific technical specifications.

The following global technical specifications are useful resources:

- *Technical specifications of neonatal resuscitation devices*, 2016 (http://apps.who.int/iris/bitstream/10665/206540/1/9789241510264_eng.pdf).
- *Technical specifications for oxygen concentrators*, 2015 (http://apps.who.int/iris/bitstream/10665/199326/1/9789241509886_eng.pdf).
- *Interagency list of priority medical devices for essential interventions for reproductive, maternal, newborn, and child health*, 2015 (http://www.who.int/medical_devices/md_maternal_BOOK_May2016_D.pdf).



Clinicians discuss the care of a hospitalized child who is receiving oxygen therapy through nasal prongs.

Technical specifications for oxygen technologies and supplies should be developed based on existing international standards, evidence-based literature, and in collaboration with expert stakeholders.

TABLE 1

FACTORS TO CONSIDER IN REVIEWING AND DEVELOPING TECHNICAL SPECIFICATIONS FOR OXYGEN TECHNOLOGIES AND SUPPLIES

CATEGORY	CRITERIA
Intended use	<ul style="list-style-type: none"> • Level of the health facility. • Patient population. • Number of patient beds. • Prevalence of hypoxemia. • Additional accessories and devices needed for safe and reliable oxygen delivery.
Operation	<ul style="list-style-type: none"> • Functional and performance specifications. • Desired product characteristics. • Design needs and constraints. • How the product fits in the clinical system/process.
Current practice	<ul style="list-style-type: none"> • Currently available and functioning oxygen technologies. • Current diagnosis and treatment procedures. • Current capacity for installation, management, maintenance, and decommissioning of oxygen technologies and supplies.
User profile	<ul style="list-style-type: none"> • Human resources, skills, and training for operation of oxygen technologies and supplies. • Human resources, skills, and training for administration of oxygen therapy and hypoxemia management. • Human resources, technical skills, and engineering training for maintenance and repairs.
Environment	<ul style="list-style-type: none"> • Electricity. • Temperature. • Humidity. • Elevation. • Dust.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

- **Oxygen Is Essential: An Issue Brief**
- **Oxygen Is Essential: A Policy Brief**
- **Global Guidelines for Shaping National Oxygen Policy**
- ▶ **Oxygen Technologies and Supplies**
- **Guiding Questions for Oxygen Scale-up**
- **Mapping a Future for Oxygen Access for All: Ethiopia’s Experience**
- **Oxygen Messaging Map**

It is available at sites.path.org/oxygen-therapy-resources/oxygen-primer





GUIDING QUESTIONS FOR OXYGEN SCALE-UP

Expanding access to oxygen delivery systems that are suitable, sustainable, and economically feasible at a national, subnational, or health facility level requires an examination of the local context and the policy and funding environments.

This resource guides decision-makers through **eight essential questions** that will help lay the foundation for an oxygen scale-up strategy. These questions focus on the environmental context, and how that influences the design and implementation of an oxygen scale-up strategy. Identifying, understanding, and engaging key

stakeholders is important for each step of the process (see Figure 4) and is critical for the success of any scale-up effort. Stakeholders may include health care providers, civil society, biomedical engineers, health facility administrators, medical supply managers, or implementing partners.



An Adara Development medical volunteer and Kiwoko Hospital nurse set up a bubble CPAP system for a premature baby in the Neonatal Intensive Care Unit.


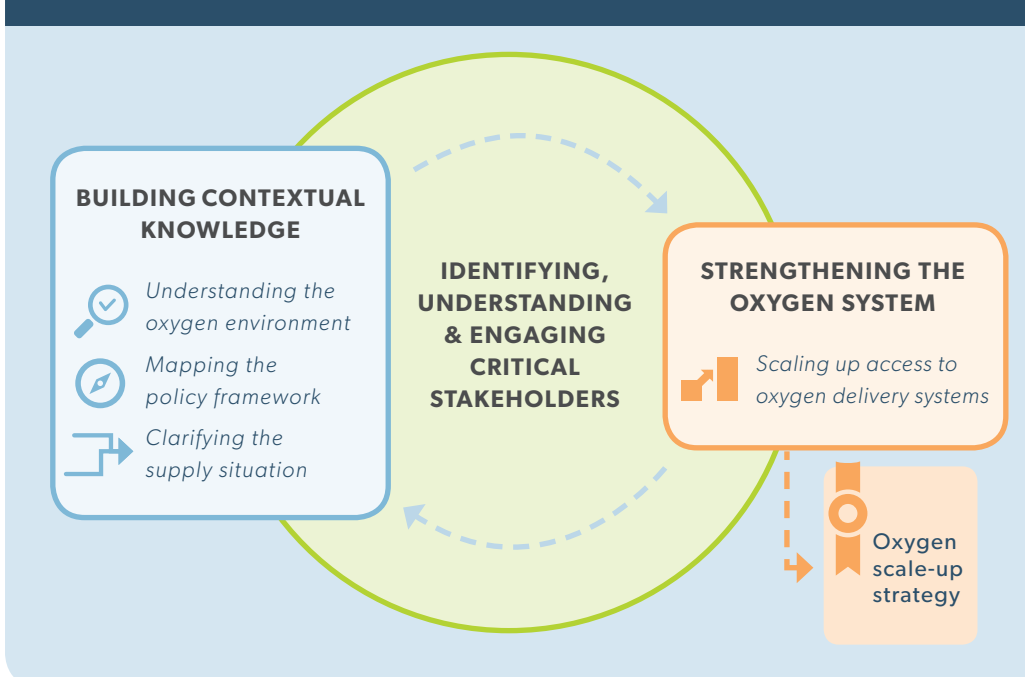
 This material can be used in conjunction with the *Oxygen Technologies and Supplies* and *Global Guidelines for Shaping National Oxygen Policy* resources provided in this primer.

FIGURE 4 LAYING THE FOUNDATION FOR AN OXYGEN SCALE-UP STRATEGY



For those responsible for determining how to increase access to oxygen delivery systems, the following questions can help guide thinking around policies, programs, and budgeting.

Understanding the oxygen environment

1. What are the oxygen needs at the facility level?

Medical oxygen supplies are required in a number of wards across a health facility (e.g., neonatal, pediatric, obstetric, surgical, emergency care), because many different patient populations develop hypoxemia. It is important to review available data on the historic and predicted epidemiological demand and supply landscape for each of the wards in national and subnational facilities in which oxygen therapy should be available. Understanding the burden of hypoxemia, as well as knowing when oxygen is and is not available to treat a condition, will ensure a scale-up strategy is attuned to local needs.

2. What is the use environment for oxygen?

A clear understanding of current service delivery practices, patient profile(s), health care worker training and availability, maintenance systems, and the facility environment will inform the safe administration of oxygen therapy and reliable operation of oxygen technologies and supplies. This understanding is best gleaned by gathering as much detailed information as possible about the current availability, functionality, and utilization of oxygen therapy, including technologies and supplies, in a range of facilities. An oxygen needs assessment is critical to identify and define what types of patients will be treated and what technologies and supplies will be needed to deliver oxygen safely. Health care providers may require specific training, depending on the technologies being used and the characteristics and clinical conditions of the patients they are treating.

Mapping the policy framework

3. Has oxygen delivery been included in appropriate national and subnational policies and guidelines?

Oxygen therapy for the management of hypoxemia should be integrated into local policies and guidelines, aligning with global guidance relevant to the country context. Local policies should promote the availability and use of oxygen with pulse oximetry across various wards within a health facility, such as pediatric, emergency, and internal medicine. It is important to understand if oxygen and pulse oximetry are included in national, subnational, and health facility-level policies, and where there may be critical gaps that impact the potential for expanding access. Key policies to investigate include strategies for key populations and conditions, such as child health or noncommunicable disease strategies, as well as service delivery guidelines, and national regulatory requirements and safety standards.

4. How are the oxygen delivery systems currently financed?

Sustainable financing is critical to support comprehensive oxygen delivery systems, including both the initial and ongoing costs of implementation—procurement, training, spare parts, utility payments, and maintenance services. It is important to know where oxygen delivery is included in the public-sector health budget; how much funding, if any, is dedicated to the oxygen delivery systems; and if there are any critical funding gaps. Consider whether new or evolving global or domestic funding mechanisms could alleviate oxygen budget concerns.

 A detailed discussion of global normative guidance related to oxygen therapy is included in the *Global Guidelines for Shaping National Oxygen Policy* resource provided in this primer.

Clarifying the supply situation



5. What is the current supply management landscape for oxygen technologies and supplies?

Sufficient stock of medical oxygen supplies, as well as related technologies and consumables, is essential to ensure oxygen therapy is available when needed, where needed, and at an affordable price. Decision-makers should assess the current supply landscape and determine whether stockouts exist across the various products needed to provide high-quality oxygen delivery—including medical oxygen supplies, consumables such as nasal prongs, and spare parts. If so, identifying the underlying causes of the shortages is critical. Moving forward, it is important to be familiar with the supply planning process for future procurement and distribution of oxygen products, as it is an occasion to identify gaps and opportunities for efficiency. The forecasting and supply planning process for all oxygen technologies and supplies should align, which will mitigate stockouts across the spectrum of oxygen delivery products. The supply chain management approach for the full spectrum of required oxygen commodities should be continually reviewed and refined.

6. Do standard technical specifications exist to guide the selection of quality-assured, appropriate, and affordable products?

Oxygen technologies and supplies can vary in their design, performance, maintenance needs, total cost, and life expectancy. It is important to review manufacturers' product specification sheets to confirm alignment with the country's or region's oxygen technology needs, including financing requirements over time. Developing locally appropriate standard technical specifications and equipment lists can lead to procurement and budgeting processes that are more efficient, achieve possible cost savings, ease replacement of consumables, and improve access to oxygen delivery systems.

Scaling up access to oxygen delivery systems



7. What mechanisms are in place for strengthening stakeholder coordination and supporting implementation?

Involvement of influential decision-makers, thought leaders, and technical experts is essential to consensus-building and successful implementation of an oxygen access scale-up strategy. Forming a technical working group—or working with an existing one—to oversee and advise on the development, adoption, and implementation of an oxygen scale-up strategy can leverage expertise; maximize government, partner, and donor efforts; and minimize duplication of resources. Ideally, the government-led group will have overall responsibility for coordinating the drafting, approval, and implementation of the scale-up strategy. The group should include clinical, administrative, support services and engineering representatives, as well as those stakeholders who can inform the development of a strategy that accounts for the policies, logistics, infrastructure, resources (human and financial), training, services, and supervision needed to support sustainable oxygen delivery systems.

8. How is the ongoing availability and functionality of oxygen delivery monitored across communities and facilities?

Regular data collection to assess the availability, functionality, and accessibility of oxygen delivery is necessary to identify critical gaps, inform the prioritization of resources, and support decisions to scale up oxygen access. Strengthening data collection and management, including key indicators for monitoring oxygen use and availability, can help to ensure oxygen therapy is consistently available. Indicators might include oxygen consumption and stock monitoring mechanisms, the number of trained biomedical engineers or technicians performing equipment maintenance, the availability of cylinder refilling sources, and the number of fully functional oxygen technologies and supplies.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

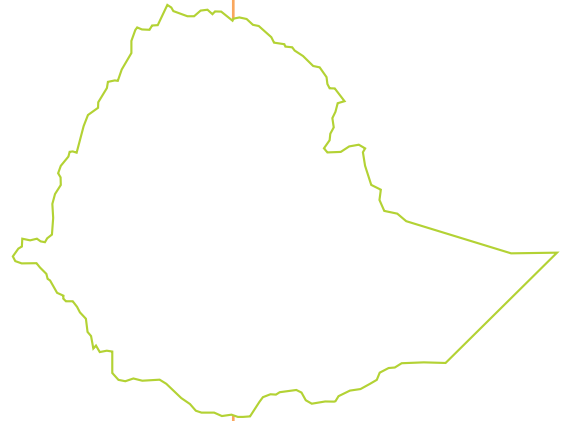
- **Oxygen Is Essential: An Issue Brief**
- **Oxygen Is Essential: A Policy Brief**
- **Global Guidelines for Shaping National Oxygen Policy**
- **Oxygen Technologies and Supplies**
- ▶ **Guiding Questions for Oxygen Scale-up**
- **Mapping a Future for Oxygen Access for All: Ethiopia's Experience**
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MAPPING A FUTURE FOR OXYGEN ACCESS FOR ALL: ETHIOPIA'S EXPERIENCE



The big picture

In Ethiopia, preventable illnesses take the lives of tens of thousands of newborns, children, and pregnant women each year. For that reason, improving their survival is a high priority for the Federal Ministry of Health (FMOH). In 2016, the FMOH initiated a major health systems strengthening effort to reduce morbidity and mortality related to hypoxemia—a severe shortage of oxygen in the blood. Hypoxemia is easily reversed with oxygen therapy; however, in Ethiopia the limited availability of functioning oxygen delivery systems in health facilities across the country means that many lives have been needlessly lost.

Scaling up access to oxygen in a country as vast as Ethiopia requires a combination of technical, financial, and political solutions. Despite the challenges in coordinating stakeholders, the FMOH realized that the return in lives saved would be a worthwhile investment, since oxygen scale-up is critical to achieving both national and global targets for reducing newborn, child, and maternal morbidity and mortality.

To guide the process, the government developed the National Medical Oxygen and Pulse Oximetry Scale Up Road Map, a five-year plan (2016-2021) that lays out a comprehensive approach for integrating oxygen and pulse

oximetry into existing policies and strategies and identifies appropriate oxygen technologies and supplies for Ethiopia's health system.

The Road Map also provides guidance for strengthening the supply chain, building capacity among health workers, and ensuring sustainable financing.

To bolster implementation of the Road Map, the FMOH collaborated with a range of domestic and global partners, including the United for Oxygen Alliance, a coalition of more than 20 organizations that provides a mechanism for partner coordination to accelerate Road Map implementation.

The Ethiopia Road Map is the first policy of its kind to coordinate oxygen stakeholders across the health system and provide guidance for a long-term strategy to scale up access to oxygen. The country's experience developing and implementing this plan provides an example for other countries interested in improving access to oxygen in their own health systems. The resulting impact will be increased access to oxygen therapy and pulse oximetry at many health care levels, and many lives saved.

A flawed national oxygen delivery system: identifying the challenges

In Ethiopia, better access to oxygen could help save the lives of an estimated 60,000 babies who would die in the first month of life, 30,000 children who would die from pneumonia each year, and 11,000 women who otherwise would die in pregnancy or childbirth. However, access to this lifesaving therapy is not reliable or guaranteed in all Ethiopian health facilities that should, according to national policy, have oxygen available. If oxygen was available when and where it is required, the health outcomes for vulnerable newborns, children, and pregnant women—as well as people suffering from trauma, chronic disease, or undergoing surgery—could be improved.

In 2016, a baseline assessment of oxygen and pulse oximetry availability and functionality in more than 314 health centers and 109 hospitals, conducted by the Clinton Health Access Initiative in collaboration with the FMOH and Pharmaceuticals Fund and Supply Agency (PFSA), demonstrated the urgent need for improved oxygen supply and utilization throughout the country.

As portrayed in the sidebar, technologies and supplies for oxygen delivery were unavailable and/or unreliable across facilities. Staff capacity to administer oxygen, maintain technologies and monitor supplies was also limited. Supplies were poorly managed, leading to shortages and

stockouts. Pulse oximetry, which is a simple but critical diagnostic tool for measuring oxygen in the blood, was nonexistent in health centers and sorely lacking in hospitals.

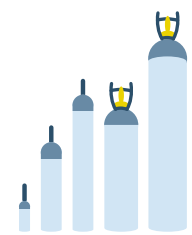
Faced with the results of this assessment, the Ethiopian government determined that a national strategy, followed by a focused implementation effort, would be required to increase access to oxygen and pulse oximetry in order to achieve alignment with the country's Health Sector Transformation Plan priorities of equity and quality and end preventable causes of morbidity and mortality.

Because access to oxygen is a multifaceted challenge that impacts numerous areas of the health system, the policy would have to meet the needs of multiple stakeholders at national and subnational levels, and across key groups—various departments of the FMOH; the Food, Medicine and Health Care Administration and Control Authority of Ethiopia (FMHACA); PFSA; and regional health bureaus (RHBs).

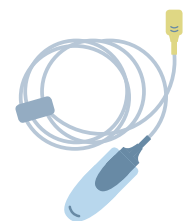
Systemic challenges included:

- Lack of policy documents on oxygen technologies and supplies, as well as minimal coordination between the FMOH and RHBs on oxygen programming.
- Erratic availability of oxygen technologies and supplies, and challenges with the supply chain for those products.
- A vast country whose geography poses supply distribution challenges.
- Lack of technical specifications to ensure standardized oxygen technologies and supplies are used across health facilities.
- Limited or no systematic plans for maintenance and supply of spare parts.
- Low knowledge and capacity among health workers to administer oxygen therapy and operate and manage oxygen technologies and supplies.
- No sustainable financing plan for the oxygen delivery system.

RESULTS OF 2016 BASELINE ASSESSMENT OF HEALTH FACILITY ACCESS TO OXYGEN IN ETHIOPIA



2% of health centers had fully functional oxygen cylinder and/or concentrator systems



62% of hospital pediatric departments were sufficiently equipped with oxygen technologies and supplies



3% of health centers and **26%** of hospitals regularly monitored oxygen consumption and stock of technologies and supplies

Seizing the opportunity: developing the national oxygen Road Map

Despite these challenges, the active political will and commitment among Ethiopia's leadership created the basis for a comprehensive response. Ethiopia's policy framework for maternal and child health was already strong, and could serve as a foundation for integration of an oxygen scale-up plan—including an implementation framework, basis for resource mobilization, and model for clinical guidance. Key existing policies included the 2015-2020 Health Sector Transformation Plan and the 2015-2020 National Newborn and Child Survival Strategy, which established ambitious targets to lower mortality rates among newborns, infants, and children younger than five years.

More broadly, oxygen (and pulse oximetry) was already part of the country's essential medicines list and national equipment list under anesthetics, although not included as an essential lifesaving medicine for the management of hypoxemia. The FMOH Ethiopian Hospitals Reform Implementation Guidelines, which pioneered health reform to

improve provision of curative and rehabilitative services, also prioritized oxygen. In addition, the Saving Lives through Safe Surgery flagship initiative identified establishment of a strong supply system for oxygen as a key priority for improving surgical care.

While the FMOH's Maternal and Child Health Directorate had initiated the Road Map effort and served as an ongoing champion, it soon became clear that a long-term, multiyear strategy was needed in order to guide the comprehensive oxygen delivery scale-up and rollout at all levels and across the many departments and partners involved. During the process of developing this plan, a consultative workshop was held to gather input and gain commitment from the private sector, nongovernmental organizations, and the country's RHBs. The final Road Map includes strategies for scale-up across the health system, including the FMOH, FMHACA, PFSA, and the RHBs.

In November 2016, the Road Map was endorsed by the Council of Directors. In December 2016, it was launched publicly with senior FMOH leadership and commitment.

TIMELINE OF KEY EVENTS

March 2016
Baseline assessment results published by FMOH and Clinton Health Access Initiative.

April 2016
Road Map drafted by FMOH through consultative process.

May 2016
Collaborative meeting held to gather input for Road Map.

September 2016
United for Oxygen Alliance formed.

November 2016
Road Map finalized and launched.

December 2016
National steering committee established to support implementation.

August 2017
Training manuals for biomedical staff and clinicians finalized.

2016-2021
Road Map implementation period.

SIX KEY GOALS OF THE ETHIOPIA OXYGEN ROAD MAP

- ★ Set a policy mandate for oxygen therapy at the national level, including providing coordination and decision support to health facilities to scale up oxygen supply.
- ★ Design, set up, and roll out a supply chain system and logistics plan to ensure sustainable oxygen supply.
- ★ Ensure sustainable supplies for hypoxemia diagnostics and related consumables at service delivery points.
- ★ Establish a mechanism for maintenance of oxygen equipment and supply of spare parts.
- ★ Institute a system for building the capacity of health care staff in supply chain management, oxygen delivery, and basic maintenance of oxygen technologies and supplies.
- ★ Ensure sustainable financing to support the oxygen supply system.

From policy to action: implementing the oxygen Road Map

Following completion and approval of Ethiopia's Road Map in late 2016, the FMOH Maternal and Child Health Directorate marshalled numerous stakeholders to support implementation of the plan. A steering committee was formed to oversee the implementation and work with a wide range of partners, which included representatives from professional medical associations, midwives, universities, and other health stakeholders. The United for Oxygen Alliance came together to support implementation of the Road Map and provide a coordination mechanism for partners working on various elements of oxygen therapy and pulse oximetry access in the country.

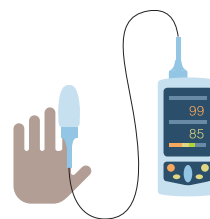
Initial implementation priorities focus on working on multiple fronts to develop a sustainable long-term approach. Near-term objectives include securing government and partner financing, construction of oxygen

plants, and capacity-building to increase the knowledge and skills of clinical workers and biomedical engineers on the management and administration of oxygen.

Data from other locations have shown significant improvements in use, delivery, and clinical outcomes of oxygen therapy when workers are well trained. For that reason, the steering committee and technical working groups prioritized development of two essential training guides—for biomedical engineers and clinical staff—to immediately support capacity-building efforts. Training will commence for these groups once the guides are completed and approved by the FMOH.

Another immediate priority is securing the national stock of oxygen technologies and supplies, including cylinders and pulse oximeters. The government intends to standardize procurement of these technologies to ensure the supply is scalable and sustainable.

RESULTS OF 2016 BASELINE ASSESSMENT OF HEALTH FACILITY ACCESS TO OXYGEN IN ETHIOPIA



0% of health centers had pulse oximeters



45% of hospitals had functional pulse oximeters



14% of hospital staff had received any training on providing oxygen therapy



Assist International

FACTORS FOR SUCCESS

Modeling the Road Map approach for oxygen therapy

Ethiopia's successful development of a plan to guide oxygen scale-up offers experiences and lessons that can guide other countries considering options for reducing hypoxemia-related morbidity and mortality, particularly for the most vulnerable. While no one approach will meet every country's needs, advocates and decision-makers can take important lessons from Ethiopia's experience as they initiate efforts to scale up oxygen within their own country contexts.

★ **Political will and leadership are critical for initiating and sustaining the process.** Having the right champions and engaging the right decision-makers—at the right time—was crucial for gaining national and subnational support, participation of contributors across the health system, and, ultimately, adoption of the national Road Map. The coordination of efforts through the creation of the steering committee, technical working groups, and United for Oxygen Alliance helped to leverage resources and relationships and overall strengthen efforts.

★ **Scaling up oxygen requires a systematic and comprehensive approach.** The Road Map was the first policy of its kind in Ethiopia, providing guidance, standardization of oxygen technologies and supplies, and national coordination to avoid duplication of activities and identify where and how gaps in oxygen delivery needed to be filled.

★ **A sustainable strategy must prioritize resource mobilization and reliable, long-term financing.**

A well-functioning oxygen delivery system requires adequate funding, tools, expertise, human resources, as well as procurement, information, and maintenance support to ensure consistent and reliable detection of hypoxemia and provision of oxygen therapy.

★ **Localized data and scale-up strategies are critical.** Supporting existing national and subnational strategies and policies, and working within the local context and existing health system are key to ensuring sustainable scale-up of medical oxygen and pulse oximetry. A baseline assessment exposing the regional variation and gaps in oxygen delivery and potential number of Ethiopian lives that could be saved provided the evidence to justify the need to improve access to oxygen therapy in health centers and hospitals. In addition, localized scale-up strategies through coordinating and working closely with RHBs and facilities to leverage and mobilize stakeholder commitment, local resources and opportunities—in addition to the FMOH resource allocations—was key for rapid launch and implementation of the Road Map.

ADDITIONAL RESOURCES

The complete **Oxygen Primer** includes the following materials:

- **Oxygen Is Essential: An Issue Brief**
- **Oxygen Is Essential: A Policy Brief**
- **Global Guidelines for Shaping National Oxygen Policy**
- **Oxygen Technologies and Supplies**
- **Guiding Questions for Oxygen Scale-up**
- ▶ **Mapping a Future for Oxygen Access for All: Ethiopia's Experience**
- **Oxygen Messaging Map**

It is available at sites.path.org/oxygen-therapy-resources/oxygen-primer





OXYGEN MESSAGING MAP

Oxygen therapy can save millions of lives. Decision-makers should take action today to ensure equitable, predictable access for all patients.

The problem: Lack of oxygen kills.

Every year in low- and middle-income countries (LMIC), hundreds of thousands die from hypoxemia—or a low level of oxygen in the blood—because oxygen therapy is not available.

- Hypoxemia is often overlooked as a health priority, despite the fact that it can result from numerous causes—like pneumonia, newborn conditions, obstetric emergencies, and noncommunicable and infectious diseases. Many of these deaths could be prevented with oxygen therapy.

Newborns, children, and pregnant women—countries' most vulnerable populations—regularly suffer from hypoxemia.

- An estimate suggests that between 1.5 and 2.7 million cases of hypoxemic childhood pneumonia present at health facilities each year, with a significant proportion among children in sub-Saharan Africa.
- 5.9 million children under age five and 300,000 pregnant women die each year. Many of these deaths are due to causes such as pneumonia, premature birth, and obstetric emergencies—conditions in which undiagnosed hypoxemia can be present.

- More than half of all neonatal deaths are caused by preterm birth complications and neonatal pneumonia and sepsis. Many of these deaths could be prevented with oxygen therapy.
- Pneumonia is the leading infectious cause of death in children, and at least 13 percent of children with pneumonia develop hypoxemia. Hypoxic pneumonia increases the risk of mortality five-fold in sick children in LMIC.
- 15 percent of all pregnant women develop a potentially life-threatening complication that requires emergency intervention—including hemorrhage, pulmonary embolism, and eclampsia. All can cause deadly hypoxemia in the woman and her unborn baby.

Many health facilities in LMIC are not equipped to treat hypoxemia, especially beyond surgical wards.

- Studies have found that nearly half of hospitals in LMIC have inconsistent or no supply of oxygen.
- Where oxygen is available in health facilities, it is usually only available in surgery wards—and absent from the neonatal, pediatric, and maternity wards where it is also urgently needed.



PATH/Arvind Chavgi

Want to help get lifesaving oxygen to those who need it? Advocate for equitable, predictable access for all patients.

ABOUT THIS RESOURCE

These messages have been developed to help advocates communicate about the need for scaling up oxygen delivery in health facilities, and how to prioritize the issue. Advocates can mix and match these messages depending on their specific audience and their needs.

KEY FACTS



5.9 million

Number of children under five years of age who die each year due to a variety of conditions that can cause hypoxemia—including pneumonia, neonatal infections, and premature birth



300,000

Number of women who die each year during pregnancy and childbirth due to causes associated with hypoxemia—including obstetric emergencies, infections, and complications from delivery

The solution: Oxygen saves lives.

Scaling up oxygen delivery into—and throughout—all health facilities can save countless lives.

- Improved oxygen delivery systems could reduce childhood pneumonia-related mortality by 35 percent, and save the lives of more than 120,000 children with hypoxemic pneumonia each year.
- Administering oxygen therapy and other supportive care practices for severe neonatal infections could save more than 400,000 babies' lives each year.
- Oxygen delivery should be available across multiple wards, including neonatal, pediatric, and maternity, in addition to emergency rooms and intensive and surgical care.

The rationale: Scaling up access to oxygen delivery systems is feasible and globally recommended.

Oxygen delivery is globally recommended, and the World Health Organization (WHO) has developed policy and clinical guidance to support national scale-up.

- Oxygen is absent from almost 80 percent of 105 LMICs' essential medicines lists, or is listed only for use as an anesthesia.
 - Ensuring oxygen is included as a treatment for hypoxemia in national policies and guidelines, as well as prioritized in budgets, is a critical step toward demonstrating government commitment, catalyzing action, and, ultimately, driving equitable access to lifesaving health care.
 - While oxygen has been considered an essential medicine by WHO for nearly 40 years, in 2017 WHO formally recognized its critical role beyond surgery for the management of hypoxemia.
 - WHO has created global guidance to help national decision-makers and health practitioners integrate oxygen delivery into national plans, lists, and programs, as well as clinical and training materials and guidelines.
- Oxygen technologies and supplies for low-resource settings are widely available and have cost benefits.
- A system for managing hypoxemia requires the following components: an oxygen source, patient delivery systems, knowledgeable providers, and pulse oximetry for diagnosing and monitoring the level of oxygen in the blood.
 - The initial costs of oxygen technologies and supplies are quickly offset by the resulting health returns. Once made available, they quickly begin saving lives across a wide spectrum of conditions and diseases.
 - Oxygen delivery systems are a worthwhile investment and have demonstrated a return of US\$50 per disability-adjusted life year (DALY) averted, with pulse oximetry showing a return of \$3 per DALY averted.
 - Improving oxygen delivery in every health facility is cost effective because it can help in the management of hypoxemia across many different population groups, including the most vulnerable.

KEY FACTS



120,000

Pulse oximetry and oxygen therapy could **prevent more than 120,000 child deaths** each year



US\$50

Strong oxygen delivery systems have demonstrated a return of US\$50 per disability-adjusted life year averted



An analysis of 105 countries' national essential medicines lists showed that **more than 80 percent do not include oxygen**, or list it only for anesthetic indication



In 2017, WHO updated its Model List of Essential Medicines (EML) and EML for Children to **include an additional indication for oxygen as an essential medicine for the management of hypoxemia**

Countries making investments in scaling up oxygen delivery are already reaping the benefits in better health outcomes and lives saved.

- In Ethiopia, the national government has created a national medical oxygen and pulse oximetry scale-up road map that will integrate oxygen delivery into maternal, newborn, and child health programs and across facilities.

- In Western Kenya, an innovative public-private partnership has provided the financing and technical expertise for a centralized oxygen plant that distributes oxygen medical gas to every hospital in Siaya County.

ACT NOW TO SCALE UP OXYGEN DELIVERY

To save lives from hypoxemia, health policymakers and decision-makers should immediately:

- ★ Prioritize funding for implementation of oxygen delivery systems in all health facilities.
 - ★ Incorporate oxygen delivery into existing maternal, newborn, and child health policies, including national strategies, treatment guidelines, and essential medicines and equipment lists.
 - ★ Ensure adequate procurement planning of oxygen technologies and supplies, improving forecasting and quantification and integrating oxygen delivery products throughout the public health supply chain.
 - ★ Strengthen health worker training and capacity for proper use and maintenance of oxygen technologies and supplies.
 - ★ Gather targeted data on hypoxemia burden, as well as oxygen availability and consumption, to ensure that oxygen therapy is available for the full range of indications that are supported by the World Health Organization and national treatment guidelines.
- For more detailed information on these actions, please see *Guiding Questions for Oxygen Scale-up* and other resources in the primer.

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For additional resources and HO₂PE Campaign toolkit, visit sites.path.org/oxygen-therapy-resources



FOR MORE INFORMATION

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