THE LANCET Global Health

COMMISSION ON MEDICAL OXYGEN SECURITY

Reducing global inequities in medical oxygen access:

The Lancet Global Health Commission on Medical Oxygen Security

OFFICIAL SUMMARY DECK

What is a *Lancet* Commission?

A scientific review, inquiry, and response to an urgent, and perhaps neglected or understudied, health predicament

- **Science-led**
- **International collaboration**
- **Multidisciplinary**
- **Aims for (transformational) change**
- **Focused on policy and/or political action**
- **Report of no more than 20,000 words and 250 references**
- **Published in regular journal and printed as a stand-alone booklet**
- **Around two years in the making**

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What was the purpose of an Oxygen Commission?

Announced in September 2022, *The Lancet Global Health* Commission on Medical Oxygen Security sought to provide a thorough exploration of the current gaps in access to medical oxygen with recommendations to ensure that no patient dies for lack of access to this essential medicine, during routine health service delivery and public health emergencies like COVID-19.

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Who led the Oxygen Commission?

Commissioners
18 academic experts

Consultations
- Industry
- Health ministries
- Patients and caregivers

Executive
5 institutions

icddr,b · Makerere University · murdoch children's research institute · Karolinska Institutet · Every Breath Counts

Advisors
40 stakeholders from diverse sectors

Oxygen Access Collaborators
100+ global network

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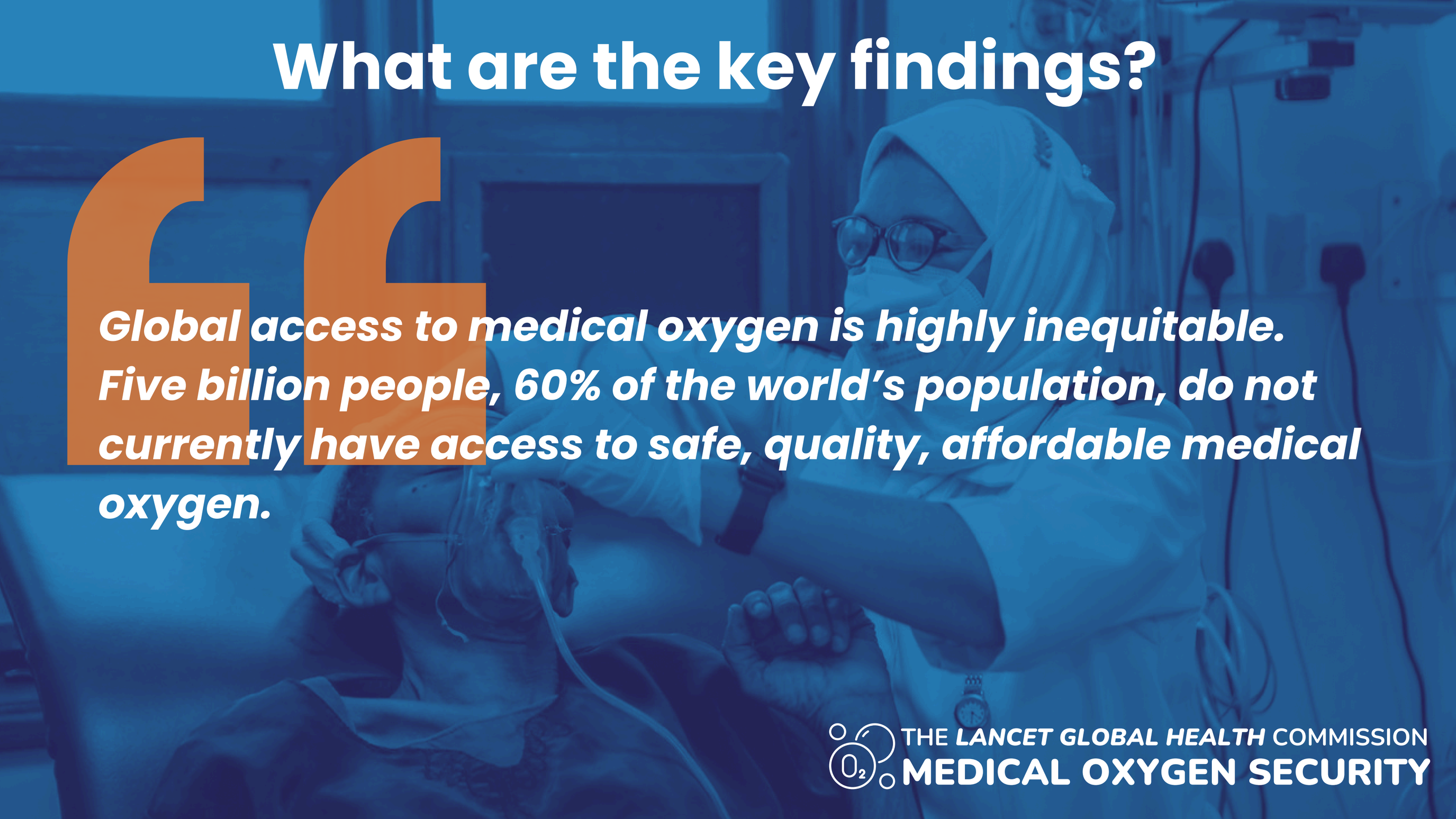
What are the key findings?



Global access to medical oxygen is highly inequitable. Five billion people, 60% of the world's population, do not currently have access to safe, quality, affordable medical oxygen.

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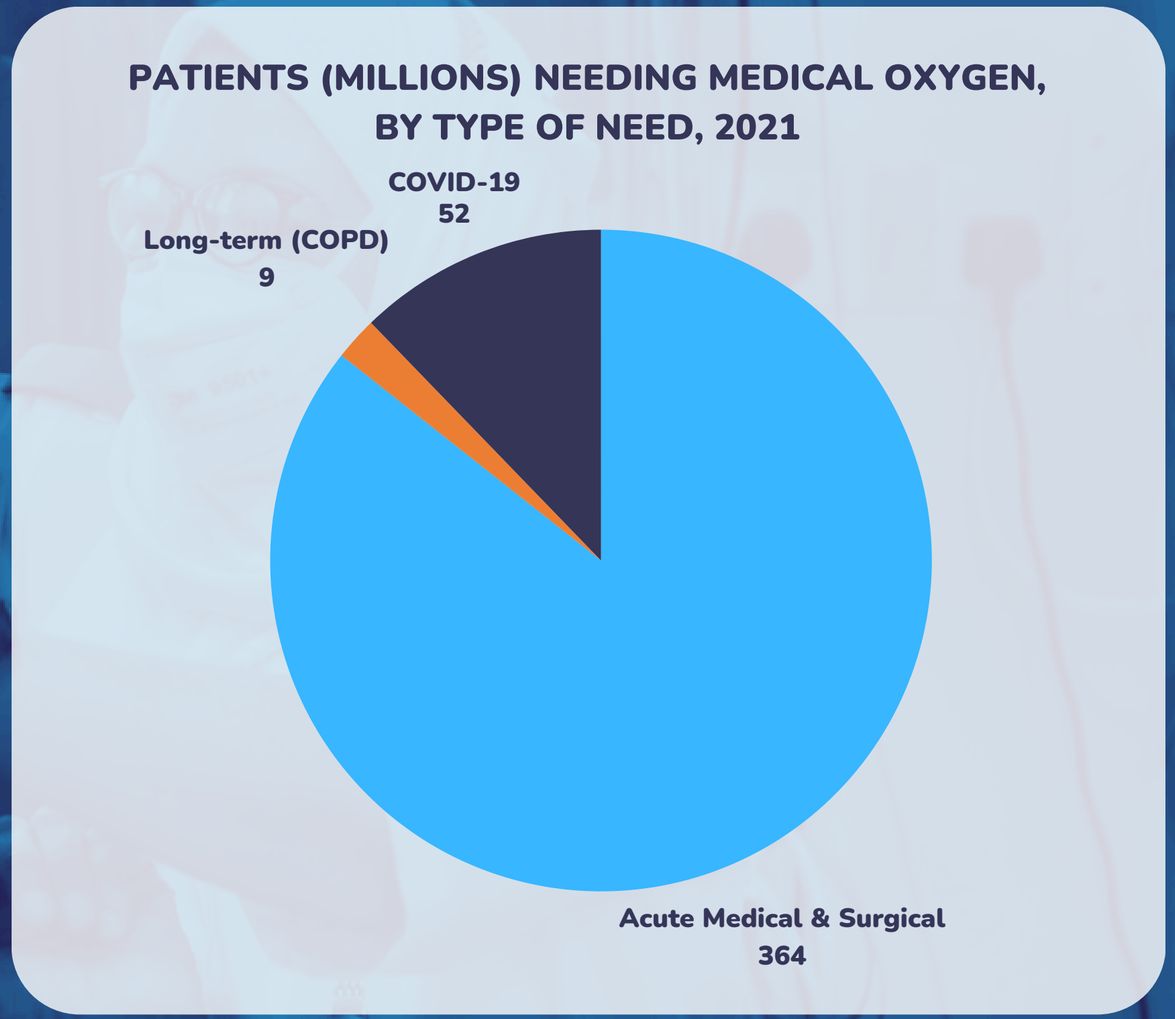
What are the key findings?

The global need for medical oxygen is high.

- Each year, 374 million newborns, children, and adults need medical oxygen, including 364 million patients with acute medical and surgical conditions, and 9 million patients with long-term oxygen needs due to chronic obstructive pulmonary disease (COPD).
- This is an underestimate.
- In 2021, 52 million COVID-19 patients also needed oxygen.



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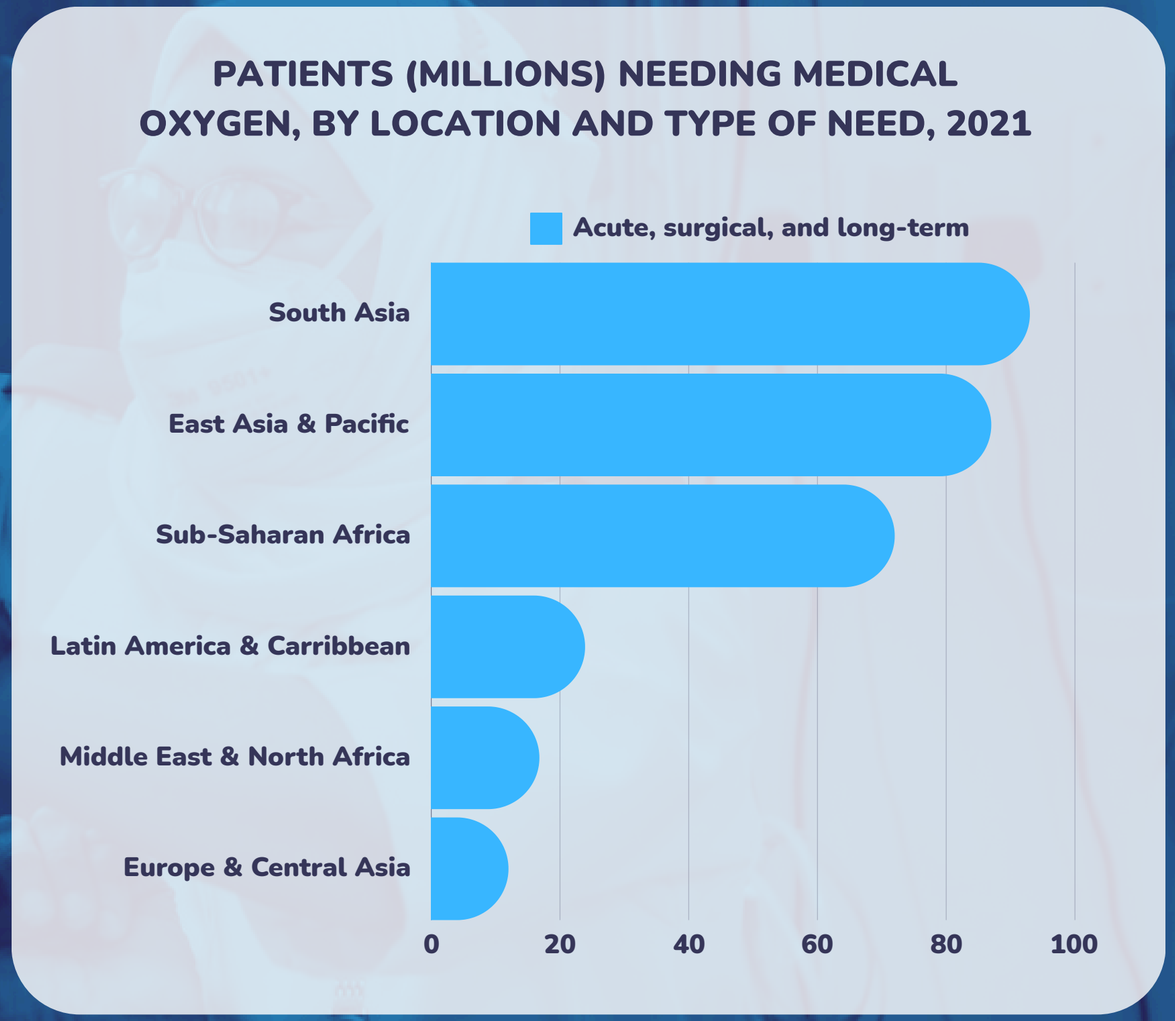
What are the key findings?

More than 8 out of every 10 patients (306 million) needing oxygen live in low- and middle-income countries (LMICs) in the following regions:

- 30% (93M) in South Asia
- 29% (88M) in East Asia & Pacific
- 24% (72M) in Sub-Saharan Africa
- 8% (24M) in Latin America & Caribbean
- 5% (17M) in Middle East & North Africa
- 4% (12M) in Europe & Central Asia



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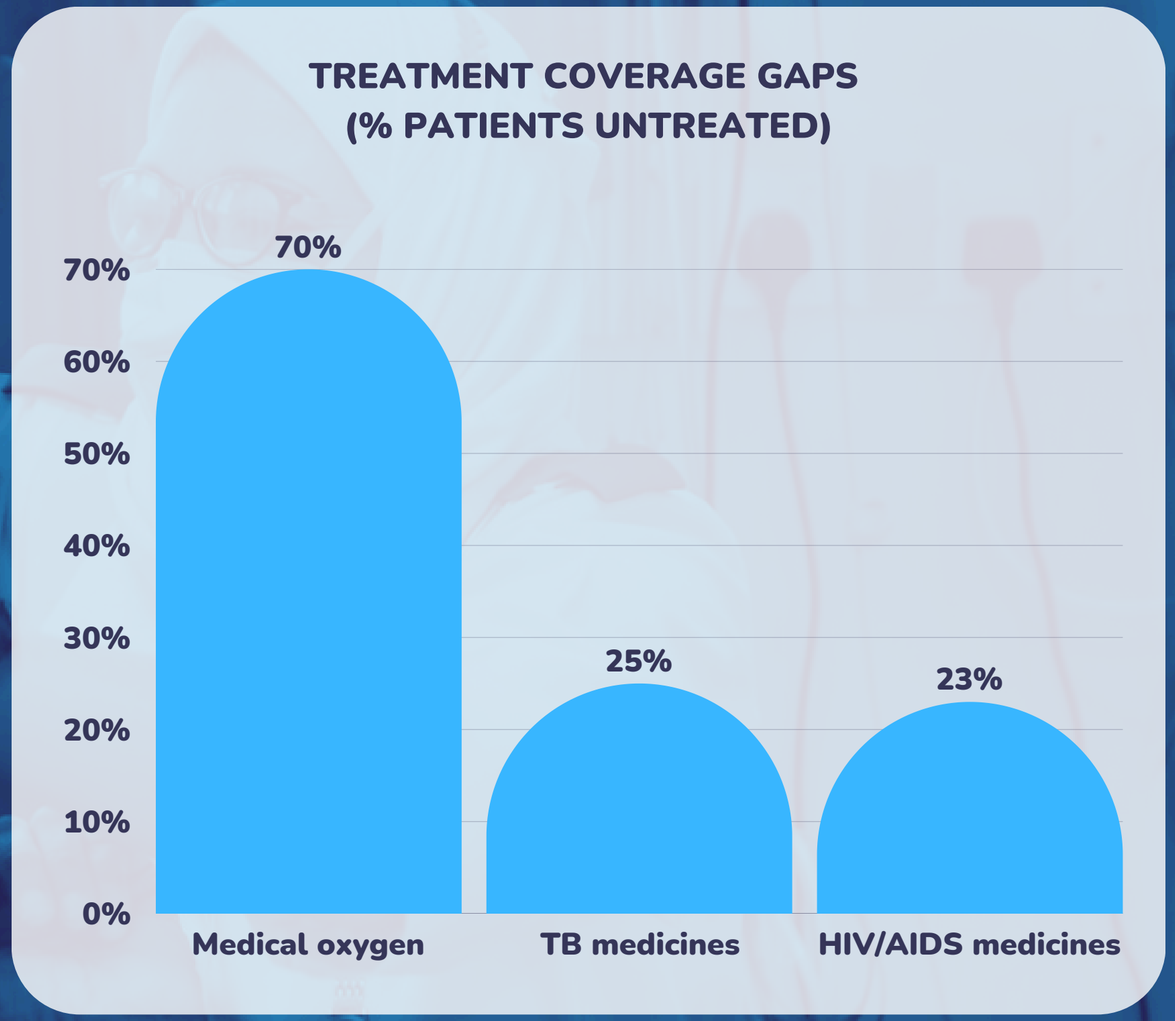
What are the key findings?

Oxygen coverage gaps are unacceptabley high in LMICs.

- Less than 1 in 3 (30%) people who need oxygen for acute medical or surgical conditions receive it.
- This 70% oxygen coverage gap far exceeds treatment gaps for tuberculosis (25%) and HIV/AIDS (23%).



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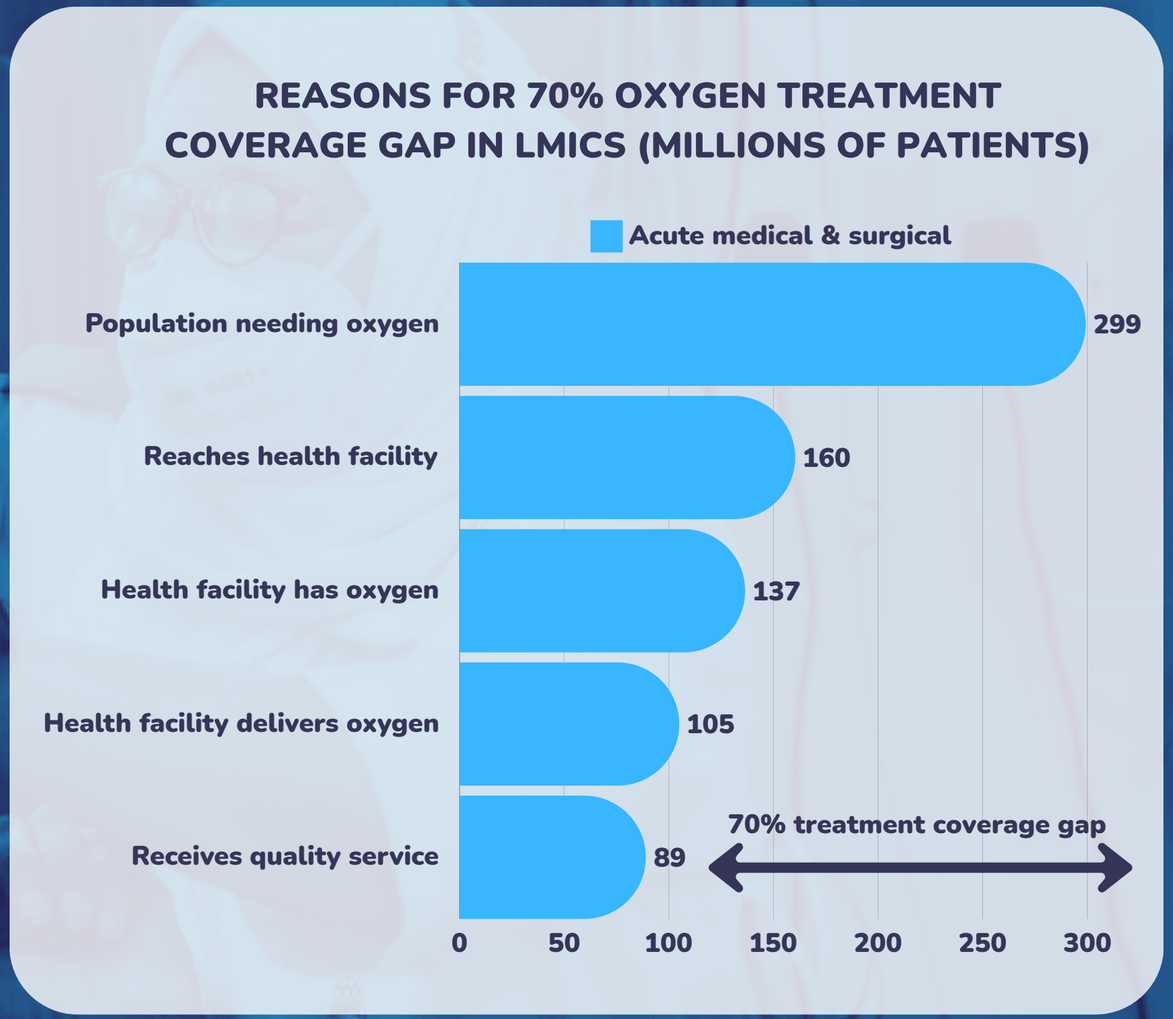
What are the key findings?

Explaining the 70% treatment coverage gap across LMICs.

- 160/299 million needing oxygen reach health facility (service contact gap).
- 137 million reach health facility with oxygen (service readiness gap).
- 105 million receive oxygen when needed (service provision gap).
- 89 million receive safe and appropriate oxygen (service quality gap).
- Coverage gaps are widest in Sub-Saharan Africa (91%), South Asia (78%), and East Asia & Pacific (74%).



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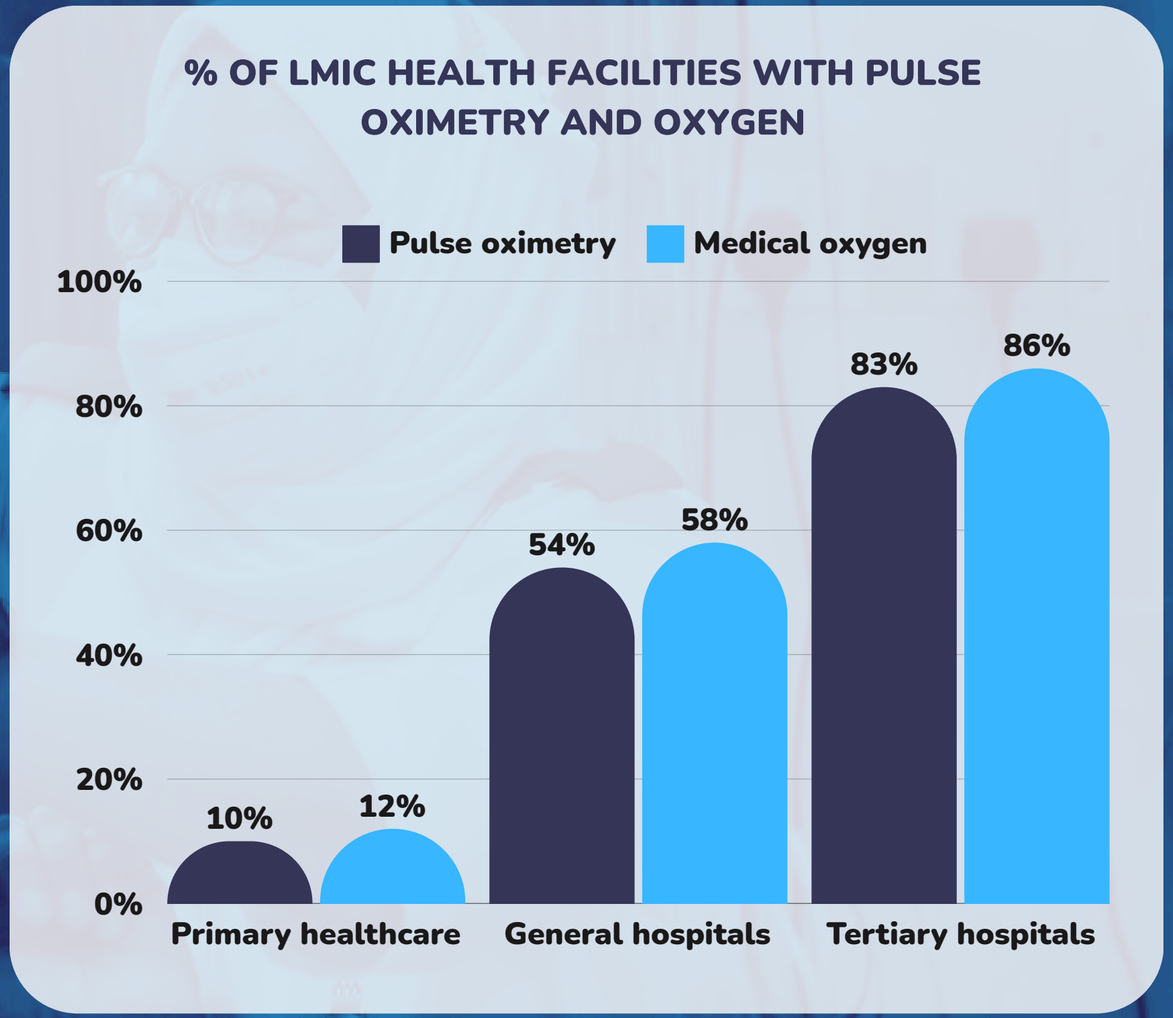
What are the key findings?

Pulse oximeters and medical oxygen are unavailable in most non-tertiary LMIC health facilities.

- Pulse oximeters available in 10% primary healthcare facilities and 54% of general hospitals.
- Oxygen available in 12% primary healthcare facilities and 58% of general hospitals.
- 83% and 86% of tertiary hospitals have pulse oximeters and oxygen.
- On any given day across LMICs, 93% of primary healthcare facilities, 45% of general hospitals, and 25% of tertiary hospitals will experience oxygen stockouts.



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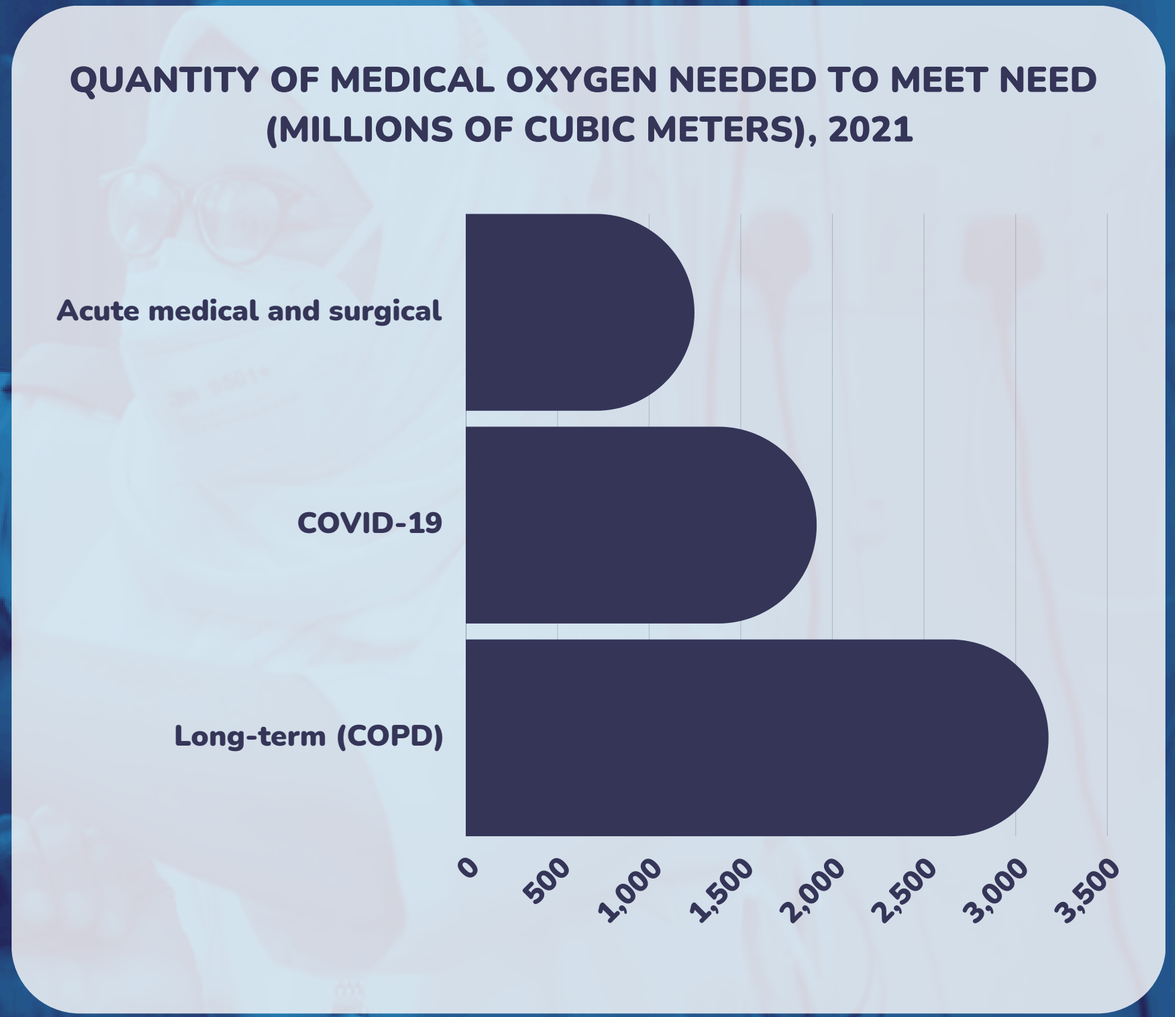
What are the key findings?

Global quantities of oxygen needed are large and rising.

- Annual need for 1.2 billion cubic metres of medical oxygen for acute medical and surgical needs.
- COVID-19 and long-term therapy needs are much higher.
- Demand is rising driven by population growth, unmet surgery needs, and demand for long-term oxygen therapy.
- Aging populations, smoking, poor diet, and air pollution are major factors driving rising demand.
- Risk of exponential surges in oxygen need during another respiratory pandemic high.



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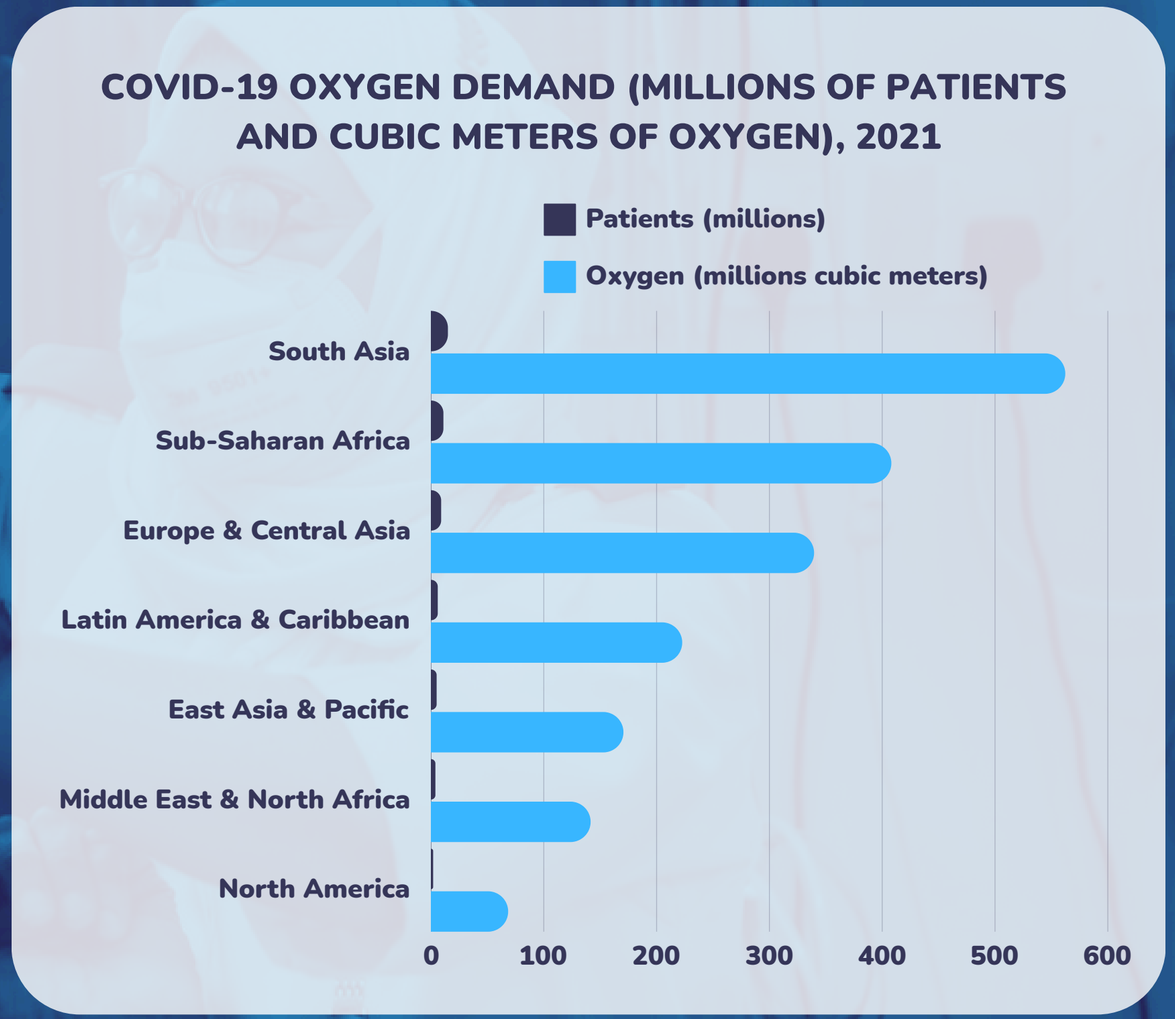
What are the key findings?

Oxygen needs can rise exponentially during emergencies.

- In 2021, an additional 52 million patients needed 1.9 billion cubic meters of oxygen to treat COVID-19 globally, putting enormous pressure on health systems.
- Excess COVID-19 mortality in 2020 and 2021 was 15.9 million globally, with most deaths in South Asia (4.4 million), Sub-Saharan Africa (2.4 million), and Latin American & Caribbean (2.3 million).



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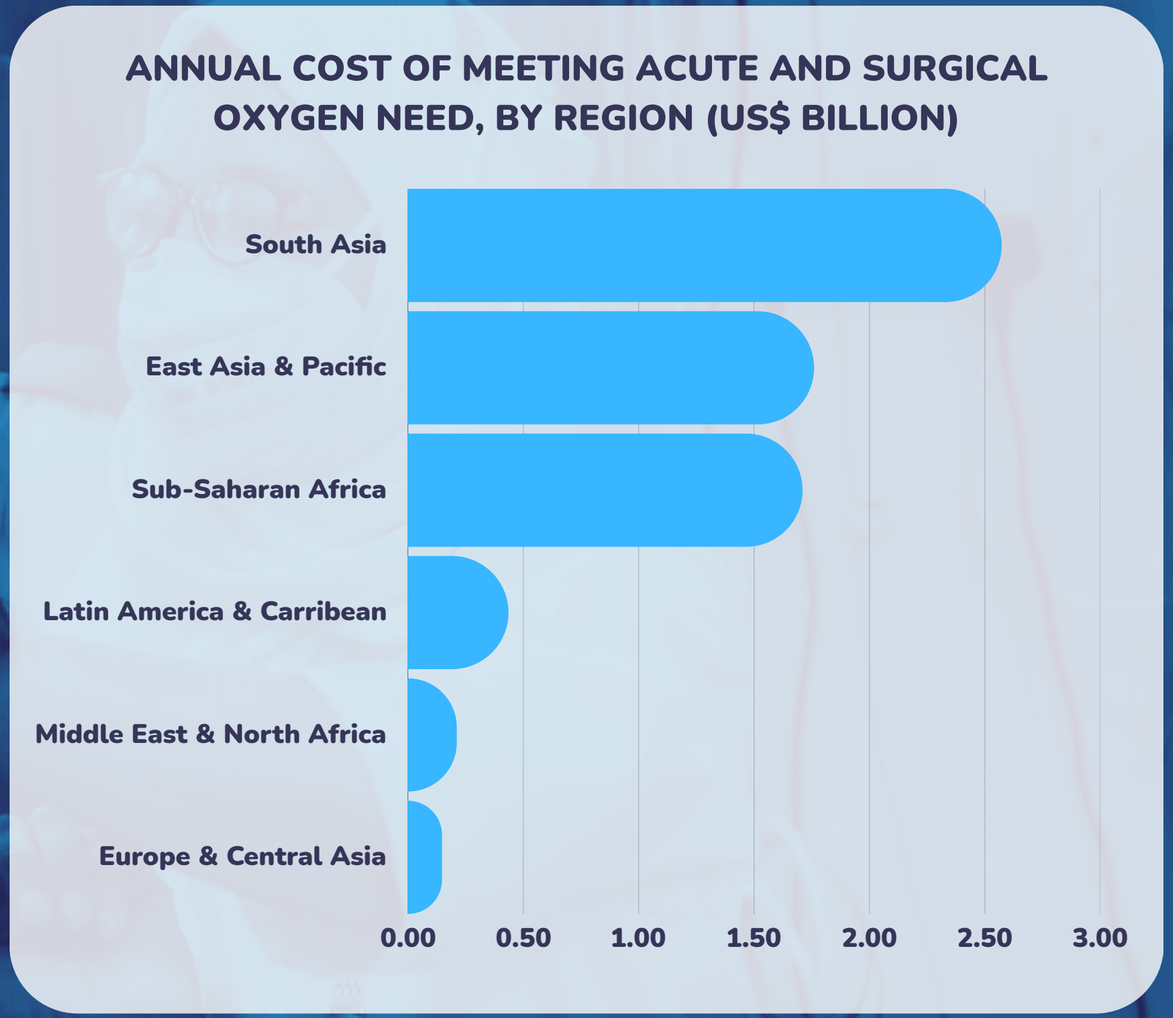
What are the key findings?

An additional US$6.8 billion is needed annually to close oxygen access gaps in LMICs.

- Equates to US$34 billion between 2025 and 2030.
- This does not include the substantial cost to finance long-term oxygen therapy services or the additional oxygen needed for future pandemics (e.g., US$6.8 billion needed for COVID-19 in 2021).



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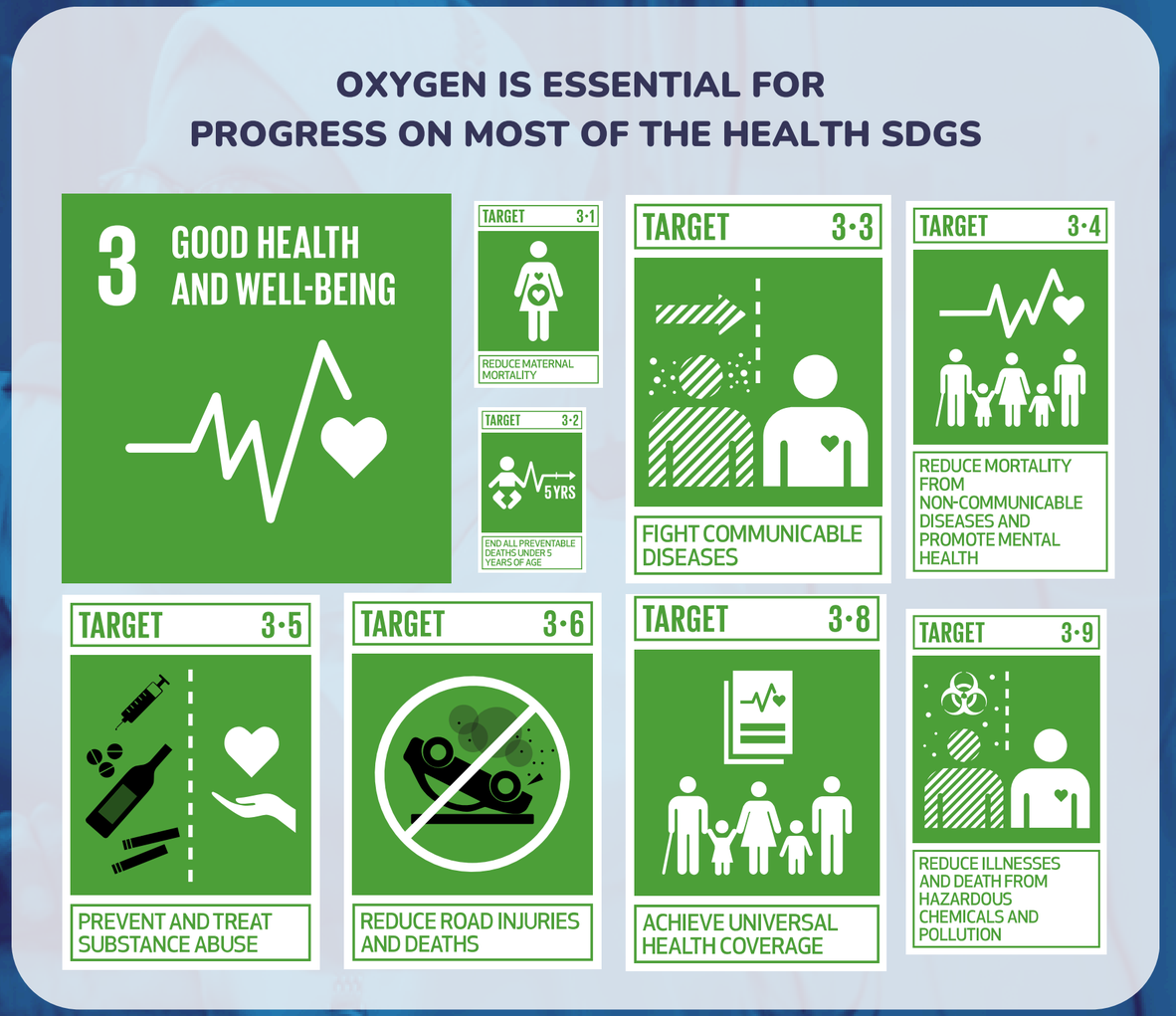
What are the key findings?

Oxygen is a highly cost-effective investment.

- As cost-effective as childhood immunization (i.e., US$59 per DALY averted).
- Accelerates progress on eight of the nine health-related Sustainable Development Goals (SDGs).
- Strengthens health systems for pandemic preparedness and response.



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What are the key findings?

Wide adoption of new monitoring tools can drive progress.

- Access to Medical Oxygen Scorecard ($ATMO_2S$) for governments to report their progress implementing the World Health Organization (WHO) Access to Medical Oxygen Resolution in 2026, 2028, and 2030.
- Ten Core Oxygen Indicators to monitor universal access to safe, quality, affordable pulse oximetry and medical oxygen services.

NEW TOOLS ARE AVAILABLE TO REPORT PROGRESS

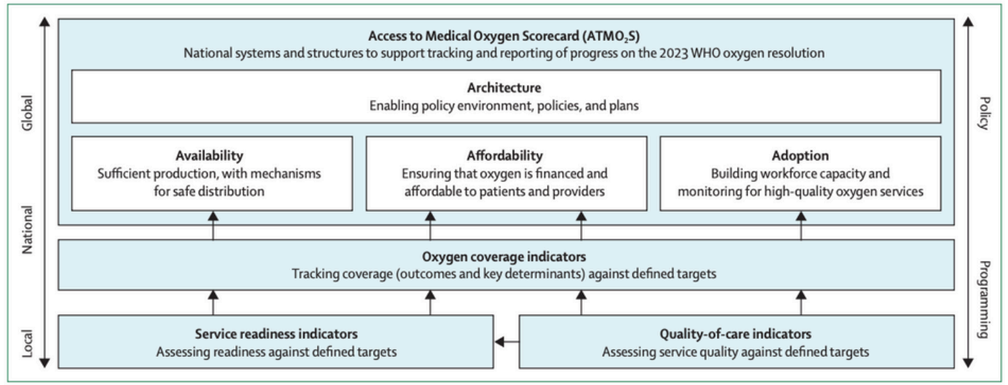
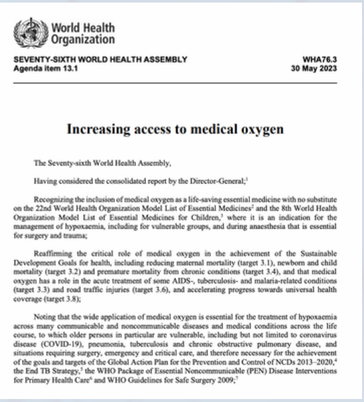


Figure 13: Proposed approach and indicators for a national medical oxygen monitoring framework

	Definition	Target
Pulse oximetry coverage*	Proportion of patients presenting to hospital with acute illness or undergoing surgery whose SpO_2 is documented at triage or admission (or during non-emergency surgery)	>80%
Oxygen production and storage capacity*	Mean (and maximum) monthly production volume (in Nm^3) of medical oxygen, and storage capacity, of each production facility (air separation units for cryogenic production of liquid oxygen or pressure-swing or vacuum-swing adsorption oxygen plants)	Individualised country targets
Pulse oximeter and oxygen availability*	Number and proportion of acute ward areas in health facilities with a functional pulse oximeter and an oxygen supply sufficient to meet patient need in the past month	100%
Pulse oximetry and oxygen service accessibility	Proportion of the population who can access, within 2 h, a health facility that provides low-flow oxygen services, including pulse oximetry measurement and monitoring	100%
Hypoxaemia prevalence	Proportion of patients attending a health facility who have hypoxaemia (ie, SpO_2 <90%) at triage or admission	None (reflects magnitude of oxygen need)
Oxygen coverage	Proportion of patients with hypoxaemia (ie, SpO_2 <90%) at triage or admission to a health facility who receive oxygen therapy within 1 h	>80%
Hypoxaemia-related mortality	Proportion of patients attending a health facility who have hypoxaemia (ie, SpO_2 <90%) and die before discharge or within 30 days	Individualised country targets
Clinical workforce	Number of doctors, nurses, and midwives per 10 000 population	≥44·5 clinicians per 10 000 population[100]
Biomedical engineering workforce	Number of biomedical engineers (defined broadly as per WHO[100]) per 10 000 population	≥0·4 biomedical engineers per 10 000 population†
Protection against catastrophic health expenditure	Proportion of patients receiving medical oxygen whose out-of-pocket expenditure on oxygen services is greater than 1% of their total annual household expenditure or income	<5% of patients experience catastrophic health expenditure

These indicators are most useful when used and interpreted collectively, because no one indicator in isolation provides an adequate representation of oxygen-related service provision. All targets should be adapted to the local context and given a timeline. SpO_2=oxygen concentrations in peripheral blood. Nm^3=normal cubic metres. *Highest priority and most feasible indicators. †In the absence of accepted global targets for biomedical engineering workforce, we propose a new target (appendix 1 p 102).

Table 7: Core indicators for monitoring universal access to safe, affordable, high-quality pulse oximetry and medical oxygen services



World Health Organization

SEVENTY-SIXTH WORLD HEALTH ASSEMBLY
Agenda item 13.1

WHA76.3
30 May 2023

Increasing access to medical oxygen

The Seventy-sixth World Health Assembly,

Having considered the consolidated report by the Director-General;[1]

Recognizing the inclusion of medical oxygen as a life-saving essential medicine with no substitute on the 22nd World Health Organization Model List of Essential Medicines[2] and the 8th World Health Organization Model List of Essential Medicines for Children,[3] where it is an indication for the management of hypoxaemia, including for vulnerable groups, and during anaesthesia that is essential for surgery and trauma;

Reaffirming the critical role of medical oxygen in the achievement of the Sustainable Development Goals for health, including reducing maternal mortality (target 3.1), newborn and child mortality (target 3.2) and premature mortality from chronic conditions (target 3.4), and that medical oxygen has a role in the acute treatment of some AIDS-, tuberculosis- and malaria-related conditions (target 3.3) and road traffic injuries (target 3.6), and accelerating progress towards universal health coverage (target 3.8);

Noting that the wide application of medical oxygen is essential for the treatment of hypoxaemia across many communicable and noncommunicable diseases and medical conditions across the life course, to which older persons in particular are vulnerable, including but not limited to coronavirus disease (COVID-19), pneumonia, tuberculosis and chronic obstructive pulmonary disease, and situations requiring surgery, emergency and critical care, and therefore necessary for the achievement of the goals and targets of the Global Action Plan for the Prevention and Control of NCDs 2013–2020,[4] the End TB Strategy,[5] the WHO Package of Essential Noncommunicable (PEN) Disease Interventions for Primary Health Care[6] and WHO Guidelines for Safe Surgery 2009;[7]

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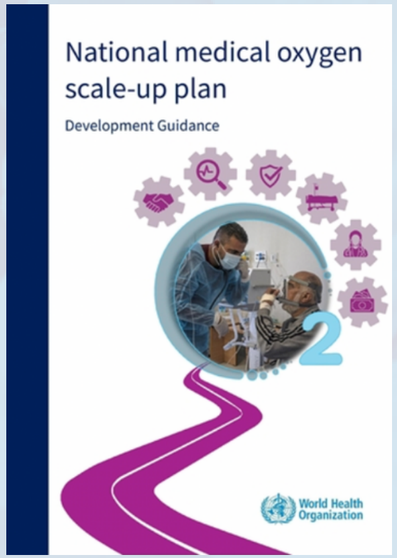
What are the key findings?

Greater investment in innovations to close oxygen coverage gaps are urgently needed.

- 20 priority areas for oxygen innovations highlighted under categories of pulse oximetry and oxygen use (4), oxygen supply systems (7), coordination (6), and markets and regulation (3).

20 PRIORITY AREAS FOR INNOVATION



Open Oximetry

Hewatele
Saving Lives, One Breath at a Time

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What are the key findings?

Research priorities

- **To foster further research and close remaining evidence gaps, 24 research priorities published under Description (7), Delivery (12), Development (5)**

24 RESEARCH PRIORITIES

Panel 17*: Priotity research areas for oxygen systems

Description

- Establish the burden of hypoxaemia in community and facility settings, by condition, age, gender, and socioeconomic status
- Identify and describe populations who need long-term oxygen therapy, by condition, age, gender, and socioeconomic status, and the cost of meeting this need
- Establish the oxygen coverage gap at national and subnational levels, disaggregated by facility type and ward level
- Explore systematic drivers of high oxygen service costs for different patient groups, across different contexts and levels of the health system
- Describe the extent, facilitators, and consequences of anti-competition practices in the medical oxygen market
- Describe the impact of smoking cessation, increased vaccination, reduction in occupational exposures, and improved air quality on demand for medical oxygen
- Understand the physical and psychological effects, experience, and consequences of hypoxaemia and oxygen therapy, by condition, age, gender, and socioeconomic status

Delivery

- Assess the effectiveness, reliability, and sustainability of different mixed-supply oxygen systems across diverse contexts to better understand the best use cases and the influence of local context and systems
- Assess the effectiveness, reliability, and sustainability of different models of oxygen system management (including production, distribution, maintenance, and repair) across diverse contexts and levels of the health system
- Establish the cost-effectiveness of different medical oxygen sources, across contexts and levels of the health system
- Develop and assess strategies to improve the rational and efficient use of oxygen, such as different SpO_2 cutoffs and oxygen conservation devices
- Develop and assess strategies to improve the safety of oxygen therapy for at-risk populations, particularly preterm neonates (eg, different SpO_2 targets, oxygen automation devices)
- Develop and assess strategies to reduce out-of-pocket costs for patients for medical oxygen services by level of health facility, condition, age, gender, and socioeconomic status, nationally and subnationally
- Assess the effectiveness of different oxygen delivery devices, including advanced respiratory devices, for neonates, children, and adults with different conditions and across different contexts
- Measure the effectiveness of different models for building workforce capability for medical oxygen therapy use in different contexts, and at scale
- Assess the implementation of pulse oximetry in primary health care, with particular emphasis on understanding population and contextual factors that influence adoption, sustainability, and impact on referral and clinical outcomes of pulse oximetry use
- Assess the effectiveness and cost-effectiveness in terms of mortality, morbidity, and quality of life of different SpO_2 cutoffs for referral and treatment initiation across different patient conditions
- Establish the functionality, impact, and sustainability of the investments in medical oxygen systems made during the COVID-19 pandemic, including the current operational capacity of pressure swing adsorption oxygen plants, oxygen concentrators, and pulse oximeters.
- Assess the impact of oxygen support and related tools provided to low-income and middle-income countries by members of the Global Oxygen Alliance

Development

- Develop mathematical models to forecast the number of people who might need medical oxygen, the volumes of oxygen required for a range of future emergencies (including pandemics, natural disasters, climate change, and conflicts), and the capacity of oxygen systems to meet these needs
- Develop tools and methods to collect and integrate hypoxaemia and oxygen service data into routine health information systems and disease surveillance systems, including for epidemic preparedness and response
- Develop oxygen production, storage, and delivery technologies that are suitable for humanitarian and emergency contexts (eg, portable devices, devices with integrated power solution, devices that can tolerate heat and humidity)
- Develop measurement devices and tools that utilise artificial intelligence and the internet of things to better monitor medical oxygen production, demand, use, and quality
- Develop low-cost, high-quality pulse oximeters that work effectively across all age groups and skin pigmentations

SpO_2=oxygen concentrations in peripheral blood. *These research priorities are drawn from the vast body of information studied by the Commission and testimony received from stakeholders. The list is not exhaustive, and we recommend a research priority-setting exercise similar to that done to establish research priorities for childhood pneumonia.[151]

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What are the key recommendations?

The Commission's work culminates in 52 recommendations targeted to governments, industry, global health agencies, donors, civil society, academic and research institutions, and more. Recommendations are measurable and time bound (usually 2030), and an independent body should assess progress in 2027 and ensure that the results are made publicly available.

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What are the key recommendations?

Governments, by 2030 (12):

- Develop and implement a costed national medical oxygen plan, scalable for emergencies...
- Increase domestic spending for national medical oxygen systems, with a line item in government health budgets...
- Include pulse oximetry and medical oxygen services in national UHC schemes so that patients do not face financial barriers to seeking care or catastrophic costs following treatment...
- Constitute a focal point (e.g., Oxygen Desk) within Ministries of Health to coordinate activities across health, education, energy, transportation, industry, and other relevant stakeholders...
- Adopt a national minimum target of ≥0.4 biomedical engineers or equivalent per 10,000 population (equivalent to 1 per 100 hospital beds)...
- Ensure all relevant national laws, regulations, and standards mirror the WHO Pharmacopoeia definition of oxygen...
- Update all clinical guidelines, essential medicines and medical device lists, and related health policies to include pulse oximetry and medical oxygen...
- Ensure a competitive national market for medical oxygen by implementing laws that prohibit anti-competitive practices and regulations that encourage transparent pricing...
- Negotiate contracts with private medical oxygen-related companies that deliver affordable, reliable installation and commissioning, clinical and engineer training, and ongoing service contracts with multi-year warranties, and access to spare parts and technical documentation.
- Increase support to universities and other research and training institutions for medical oxygen research...

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What are the key recommendations?

Industry, by 2030 (7):

- Adopt specific access to medical oxygen targets and implement flagship oxygen access programmes, and report progress in company annual reports...
- Collaborate with global health agencies (e.g., GO_2AL) and national governments to document company progress towards oxygen access targets...
- Commit to greater price transparency and ensure compliance with competition policy and medical oxygen-related regulations in all jurisdictions...
- Increase engagement with national governments to test public-private partnership models...
- Accelerate investments in innovations that improve the cost-effectiveness of pulse oximetry, medical oxygen, and related therapies...
- Design products to meet the needs of patients and health facilities in low-resource settings...
- Contribute to the global effort to increase LMIC manufacturing of key components of medical oxygen systems (e.g., pulse oximeters, oxygen plants, oxygen concentrators, respiratory care devices, and spare parts), and supply chain management, especially across the Sub-Saharan African region...

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What are the key recommendations?

Global health agencies, by 2030 (8):

- Ensure all global clinical guidelines, essential medicines lists, and training materials appropriately include pulse oximetry, oxygen and related therapies...
- Ensure health surveys, facility assessment tools, and related data tools appropriately include pulse oximetry, medical oxygen, and related therapies...
- Accelerate inclusion of pulse oximetry, medical oxygen, and related therapies in global emergency preparedness instruments...
- Increase support to national governments to develop National Oxygen Plans...
- Coordinate global oxygen-related activities within and across agencies, engaging with GO_2AL to maximize impact and minimise fragmentation and duplication of effort...
- Ensure that at least 50% of future global oxygen investments (i.e., grants, loans, equity, etc) are to support the operational costs of sustaining national medical oxygen systems...
- Ensure that procurement of oxygen supplies aligns with National Medical Oxygen Plans...
- Increase access to quality global, national, and health facility data on medical oxygen needs, coverage, gaps, and support, including by integrating hypoxaemia as a risk-factor for death and disability in the next iteration of the Global Burden of Disease...

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What are the key recommendations?

Global health donors, by 2030 (11):

- Include oxygen systems strengthening components in all relevant funding offerings...
- Increase investments in medical oxygen to accelerate both SDG achievement and pandemic preparedness...
- Support the inclusion of medical oxygen in the 8th Replenishment of The Global Fund...
- Announce a specific Pandemic Fund call to strengthen preparedness for respiratory pandemics, with a strong focus on surveillance and diagnostic tools and therapies including pulse oximetry and medical oxygen and related therapies...
- Increase funding to improve the quality of oxygen care provided to patients, including for healthcare worker training and professional institutions...
- Increase financing from Development Finance Institutions to private sector oxygen providers...
- Require grantees to apply best practices in the procurement of pulse oximeters, medical oxygen, and related equipment using Total Cost of Ownership metrics to assess prices...
- Encourage grantees to use the Core Oxygen Coverage indicators...
- Increase funding for the repair and recommissioning of broken oxygen equipment currently filling “graveyards”...
- Actively participate in the GO_2AL to maximize the impact and efficiency of donor investments and to minimize duplication of effort...
- Increase funding for oxygen-related research...

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What are the key recommendations?

Civil society, by 2030 (5):

- Integrate pulse oximetry and medical oxygen access into existing civil society health advocacy and program activities...
- Engage with governments on the development and implementation of national oxygen plans...
- Establish patient advocacy groups to ensure that the voices of patients and caregivers needing oxygen for acute medical and surgical procedures and for long-term oxygen therapy are heard...
- Engage GO_2AL to support civil society and patient pulse oximetry and medical oxygen advocacy and other activities in LMICs...
- Mobilize civil society organizations and patient advocacy groups globally to increase the impact of World Oxygen Day, held annually on 2 October...

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What are the key recommendations?

Academic and research institutions by 2030 (5):

- Increase oxygen-related research with particular emphasis on funding and training implementation science, health systems, and health economics researchers...
- Partner with government and industry to generate and apply oxygen implementation and health systems data in a timely way...
- Identify gaps in workforce capability that require creation of new programmes or certifications to meet local needs for sustainable oxygen systems.
- Embed theoretical and practical content on pulse oximetry and medical oxygen into curricula of clinical and biomedical professionals...
- Conduct research to address major gaps in access to oxygen for newborns, children, and adults, especially in the priority areas outlined by the Commission.

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What are the key recommendations?

Other key actors by 2030 (4):

International Standards Organization (ISO)

- Review all ISO standards relating to medical oxygen and related therapies to assess alignment with the WHO Increasing Access to Medical Oxygen Resolution and make recommendations, including on how to reduce fragmentation across geographies in medical oxygen-related standards.
- Ensure that at least half of all Participating Members of the Anaesthetic and Respiratory Equipment Committee (ISO/TC 121) and related sub-committees are representing national standards bodies from LMICs.

Professional Bodies

- Formalize national biomedical engineering professional associations/societies and establish or strengthen regional bodies...
- Ensure relevant clinical societies are supporting the clinical workforce in the delivery of quality oxygen services, including the use of pulse oximetry at all levels of the health system.

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Conclusion

The Commission adds its voice to the many calling for a transformation of the field of "global health," and argues that medical oxygen can be a pathfinder investment for a new era. With national medical oxygen plans at the heart of the effort, governments firmly in the driver's seat, and donor investments well-aligned with national plans, health systems can be strengthened in ways that advance many health goals simultaneously. Further, by investing in climate-sensitive, energy-efficient solutions, national medical oxygen systems can be at the forefront of the future we want – the long-term health and sustainability of our most precious resources – people and planet.

Find out more...

The full Commission package is available at www.stoppneumonia/lancetoxygencommission.org:

- Report with Comments
- Media Statement
- Policy Brief (English, French, Spanish, Arabic, Chinese, and Russian)
- Spotlight Brief: Access to Medical Oxygen Scorecard ($ATMO_2S$)
- Spotlight Brief: Patient and Caregiver Testimonies
- Spotlight Brief: 10 Oxygen Coverage Indicators
- Spotlight Brief: 20 Priority Areas for Oxygen Innovation
- Country Case Studies (Bangladesh, India, Malawi, Nigeria, Sweden, Uganda)

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