

Oxygen Systems Strengthening

Supply, Logistics, and
Implementation Challenges and
Innovations

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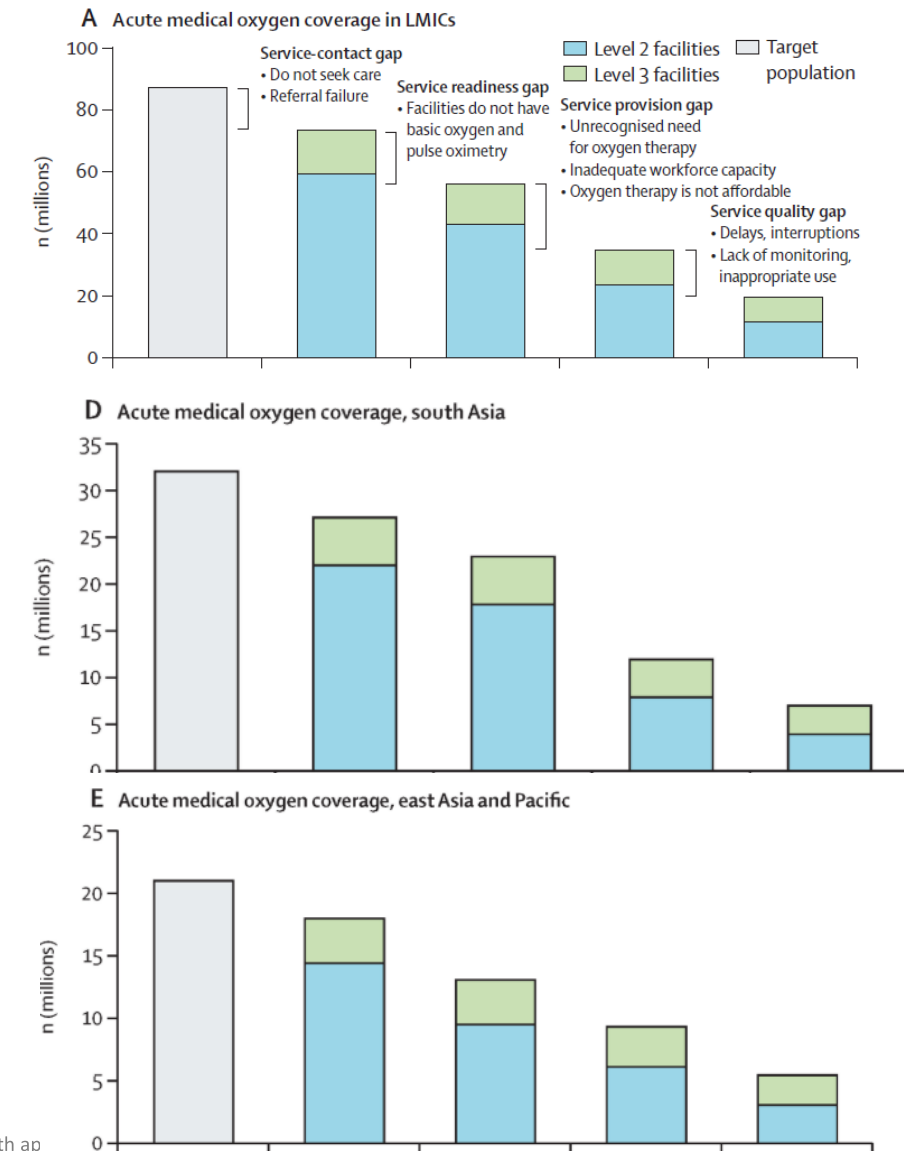
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Unmet need for oxygen is high, particularly in LMICs, and especially Asia and the Pacific¹

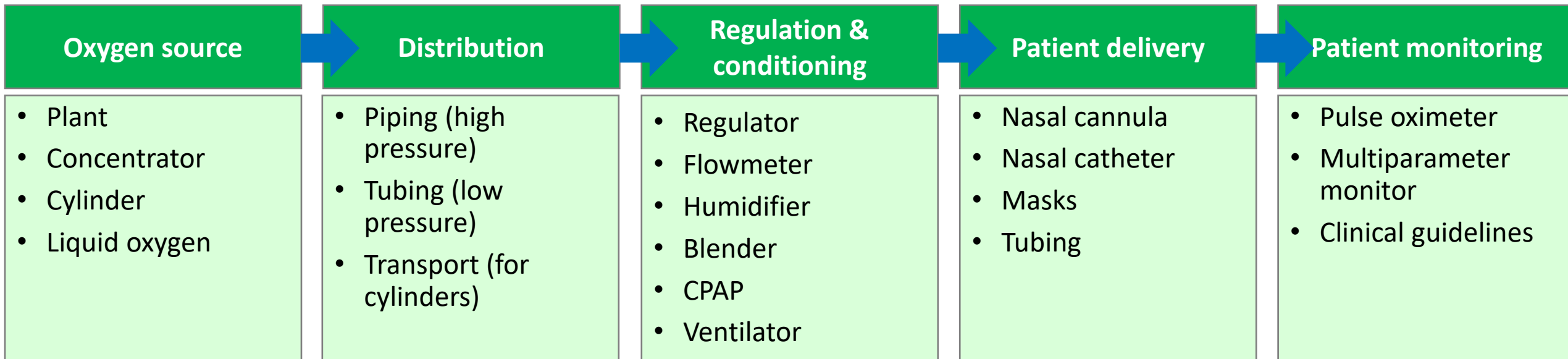
- **364 million people in need** of oxygen therapy for acute medical and surgical conditions² globally in 2021
- **82% living in LMICs** of people with acute medical or surgical need
- **51% of global need** - 186.2 million people - *in South and East Asia and the Pacific*
- **70% coverage gap** in medical oxygen services for acute medical and surgical conditions across LMICs
 - **76%** gap across Asia (74% in East Asia and Pacific; 76% in South Asia)
 - **Fewer than half** of all health facilities in LMICs have uninterrupted access to medical oxygen
- Increased needs driven by severe respiratory illnesses (COVID-19, SARS)

¹Source: *Reducing global inequities in medical oxygen access: the Lancet Global Health Commission on medical oxygen security*. Graham, Hamish Ret et al. *The Lancet Global Health*, Volume 13, Issue 3, e528 - e584

²children and adults with respiratory tract infections, traumatic injury, neonates, people undergoing surgery; excluding COVID-19

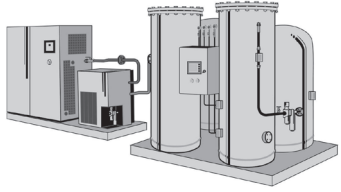


Oxygen Supply and Logistics Components at the center of early COVID-19 response



Oxygen Therapy in Response to COVID-19

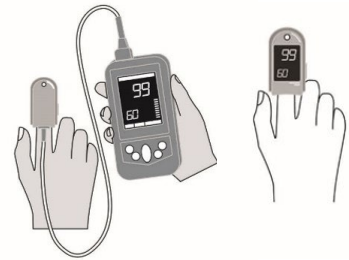
UNICEF channeled **over \$69 million in oxygen equipment and supplies** between 2020 and 2025 **across 35 countries** in South Asia, East Asia and the Pacific



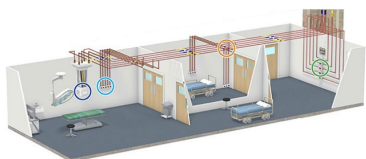
17 Pressure Swing Absorption (PSA) Plants across **10** countries **\$7 million**



24,173 Concentrators across **33** countries **\$23 million**



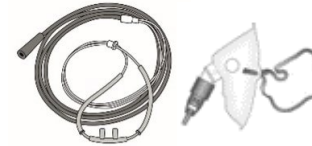
25,416 Pulse Oximeters across **32** countries **\$8.2 million**



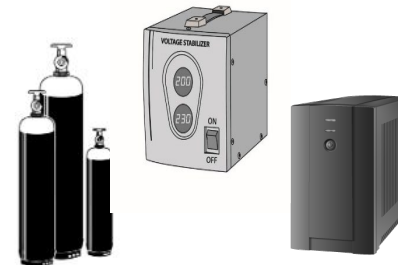
Medical gas pipeline system (MGPS)



308 CPAP Machines across **12** countries
With additional accessories and consumables **\$1.66 million**

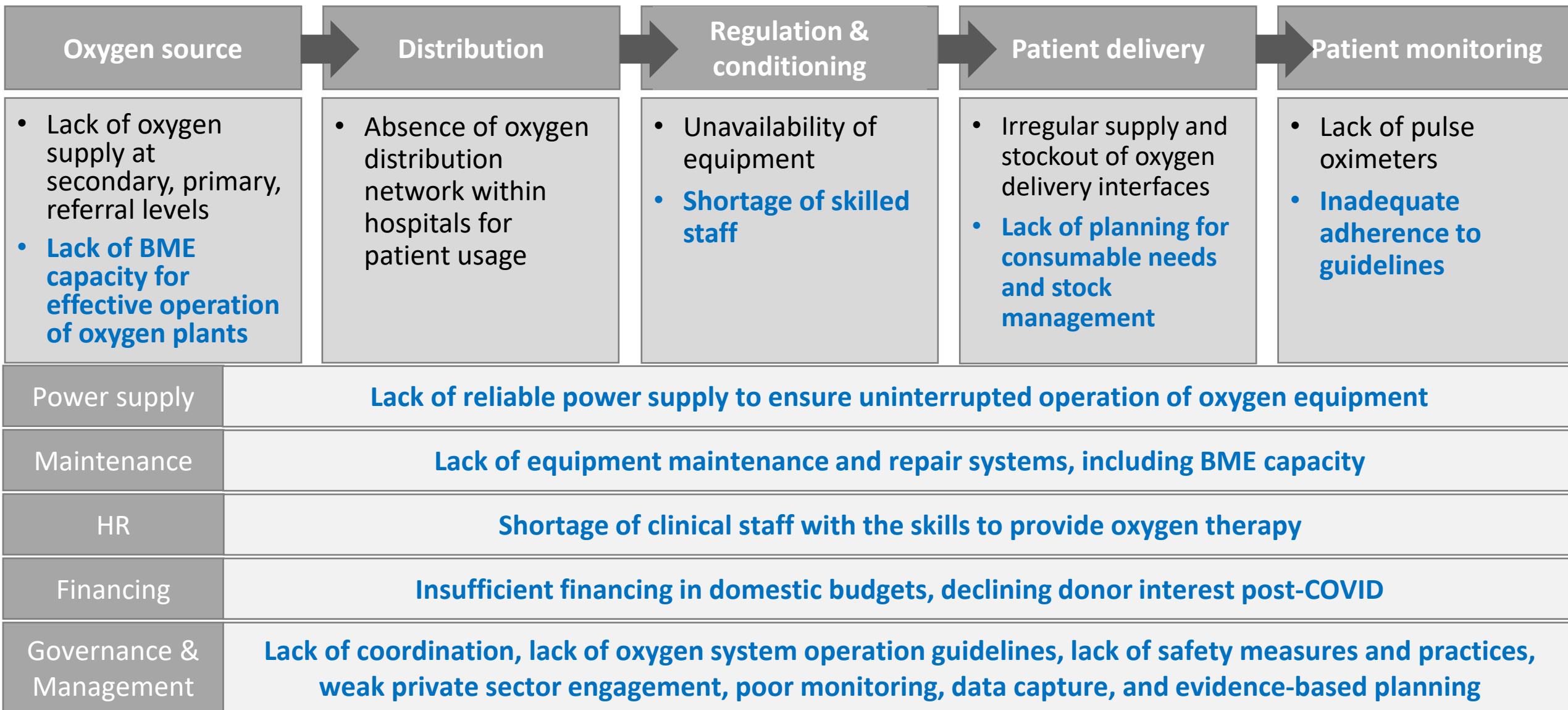


Oxygen delivery interfaces, including nasal cannula and O2 masks



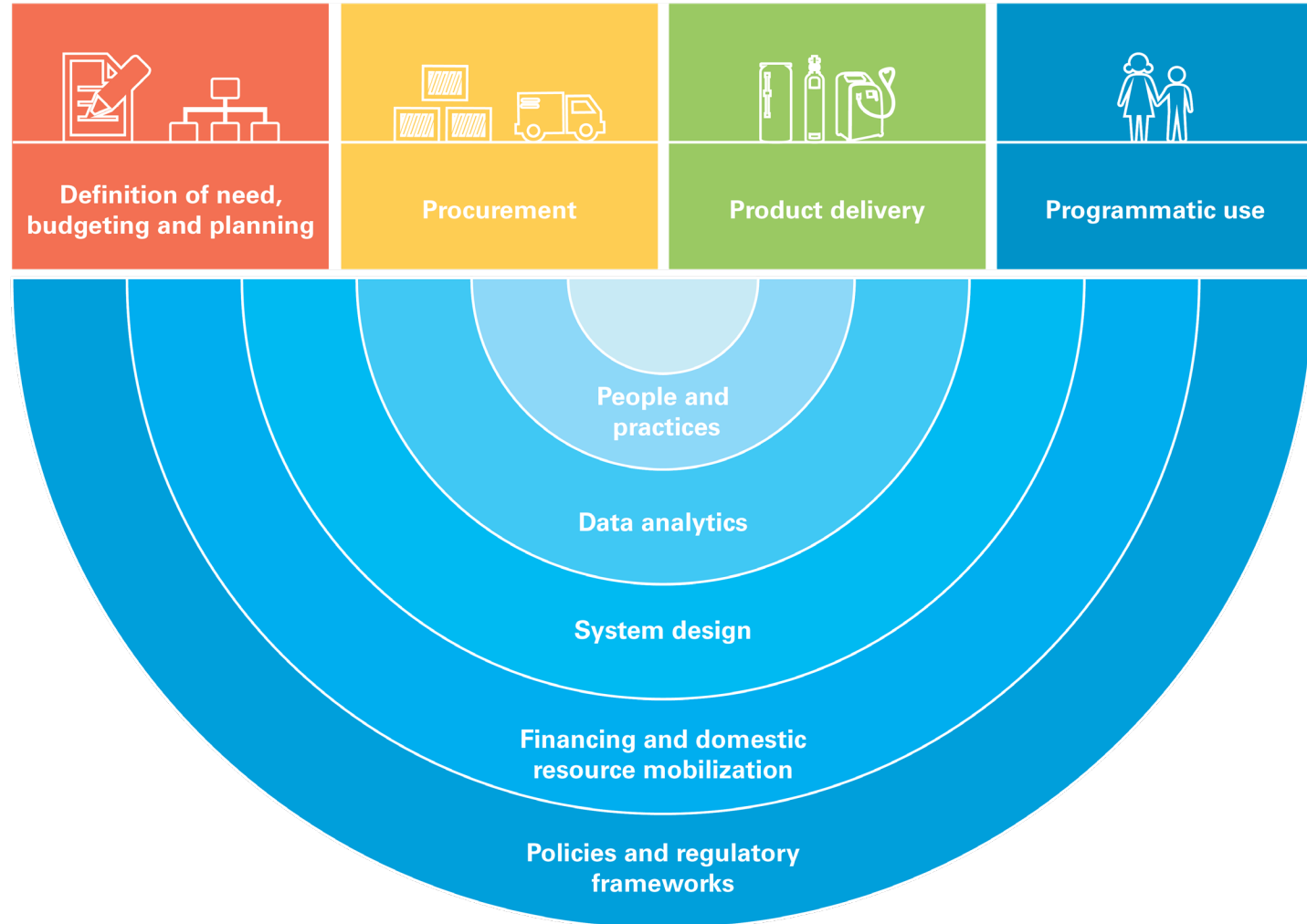
Other equipment, including oxygen cylinders, voltage stabilizers, and UPS

Operations, Maintenance, and Tracking: *Challenges and gaps identified in SAR and EAPR*



UNICEF's Oxygen Scale-up Framework

developed in response to COVID-19



Outcomes



Strengthened Primary Health Care (PHC) with:

- efficient and effective supply planning
- safe use of oxygen in maternal, newborn and child health programming.

Impact



Improved maternal, newborn and child survival



Improved pandemic preparedness and response.

Converting oxygen supplies into effective oxygen therapy requires a comprehensive systems approach

Our work emphasises that provision of oxygen is an essential public service, not just a commodity or commercial product, and that achieving equitable oxygen access will require a systems approach addressing multiple domains (production, storage, distribution, supply, clinical use, coordination, regulation, and financing) across the health, education, energy, industry, and transport sectors. Previous efforts, including major investments in response to the COVID-19 pandemic, largely focused on the delivery of equipment to produce more oxygen, but did not invest in the systems and people required to ensure equipment is distributed, maintained, and used safely and effectively. Key findings from this Commission show how future investment in strengthening oxygen systems could have a huge impact by saving millions of lives, accelerating progress towards the Sustainable Development Goals (SDGs), and preparing the world for future pandemics.

Reducing global inequities in medical oxygen access: the Lancet Global Health Commission on Medical Oxygen Security



Bangladesh Case Study

Infrastructure and Equipment

30 LMO systems in hospitals:
infrastructure and pipeline installation

81 oxygen monitoring devices

1,000+ oxygen concentrators

70 oxygen manifolds in 60 UHCs

Pulse oximeters (120 adult, 120 pediatric)

Oxygen cylinders, flowmeters, gas analyzers

Fire extinguishers in 30 LMO hospitals and 70 UHC manifolds

Guidelines and Training

Developed **pediatric guidelines** for the rational use of oxygen and related training modules

Conducted **training on rational use** of oxygen in SCANUs

Landscape analysis

SOP and Facilitator handbooks for the medical gas system

Medical gas system booklet

Capacity building for facility managers.

Training on **fire safety** and produced related guidelines.

Systems and Process Improvements

Initiated and invested in the **Oxygen Management Information System (OMIS)**

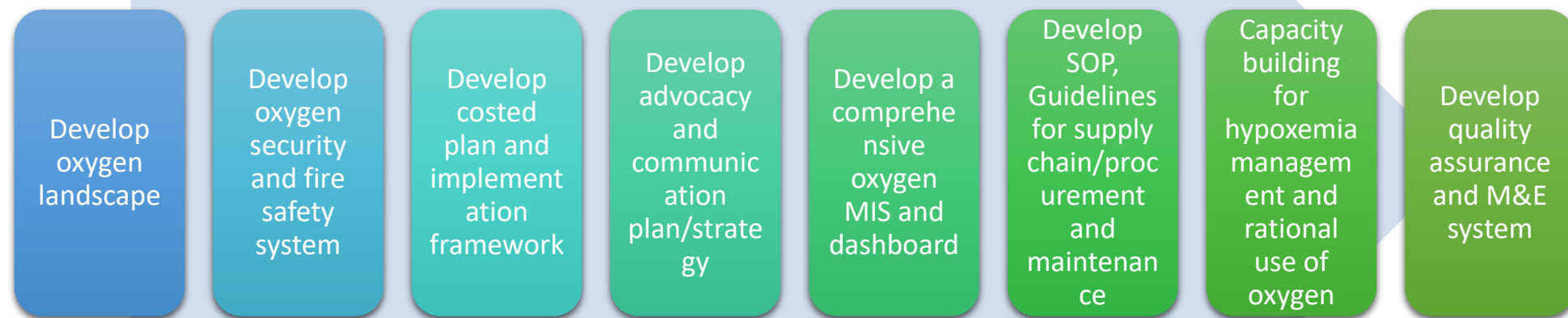
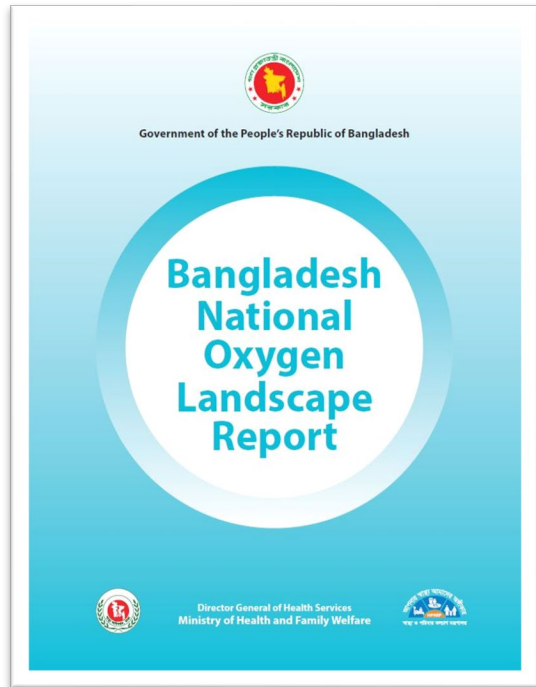
Integrated OMIS indicators into the **HMIS (DHIS2)**

Assessed quality in the nationwide SCANU, leading to **quality improvements**

Enhanced capacity on NEMMEW & TC for the overall medical gas system.

Rational use of oxygen training for healthcare professionals (HCP).

Oxygen landscape analysis and development of a roadmap for Bangladesh



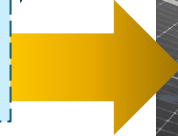
Pakistan Case Study

Planning: Comprehensive Biomedical Engineering Capacity Building Program



5 on-site PSA
Generation Plants
District Headquarters
Hospitals (DHQs) to enhance
timely provision of oxygen
and prevent Pneumonia
deaths among children

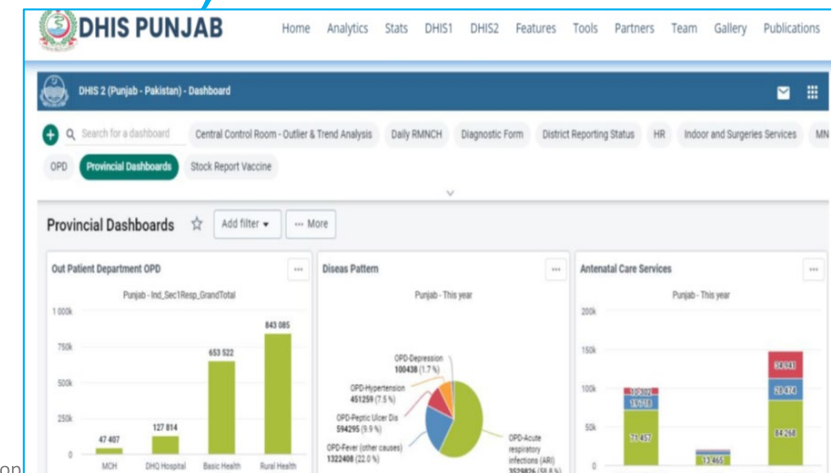
Challenge:
Power is
Expensive!



Hybrid solar power
system (Each 250 kW
capacity, 200 kW on-grid
& 50kW hybrid with 50
kWh batteries) at 3 DHQs

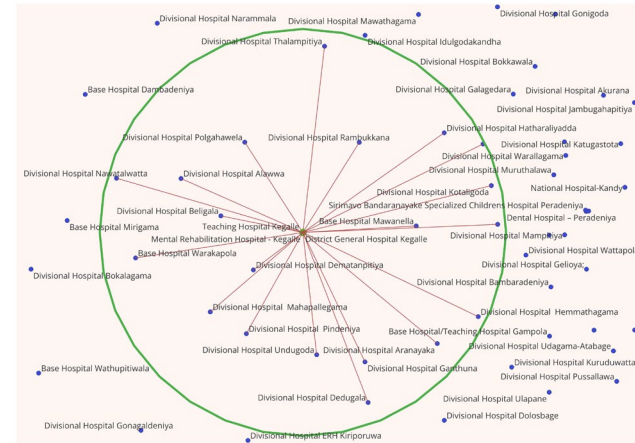
Scaling Pneumonia Responsive Interventions (SPRINT)

- Oxygen **indicators embedded in HMIS**, including mobile entry at service delivery point
- Implementation of **Oxytherapy Guidelines** for MNCH, focus on QA of hypoxemia management
- Sustainability concerns and considerations



Sri Lanka Case Study

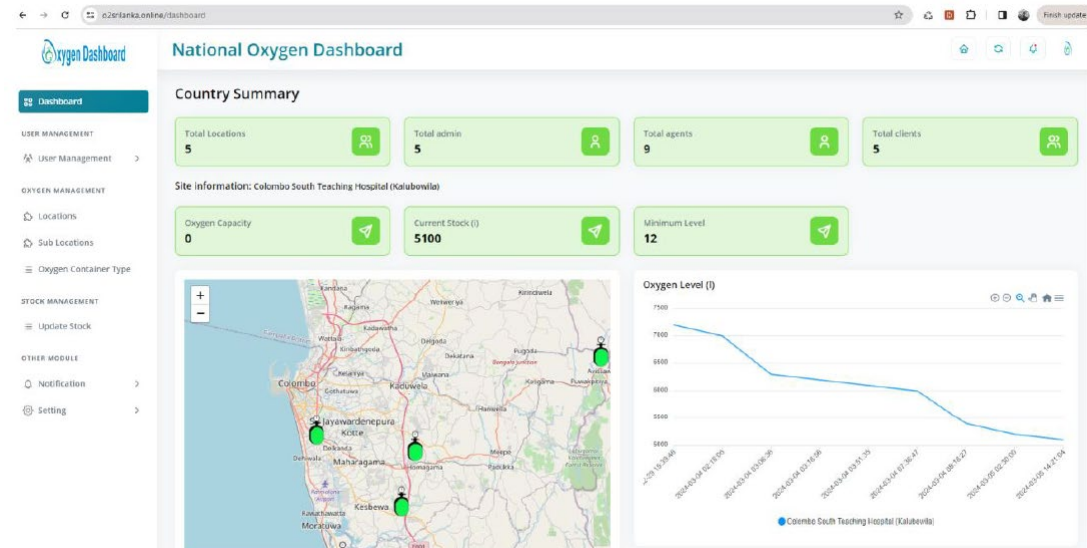
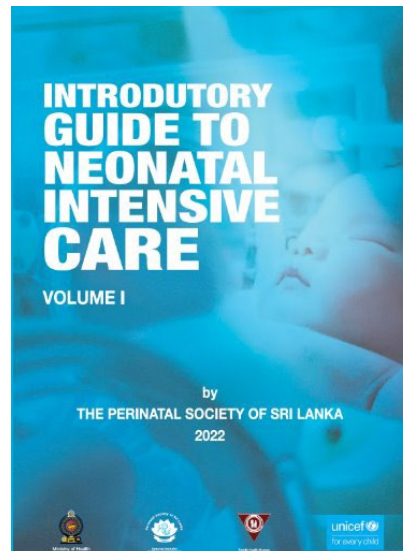
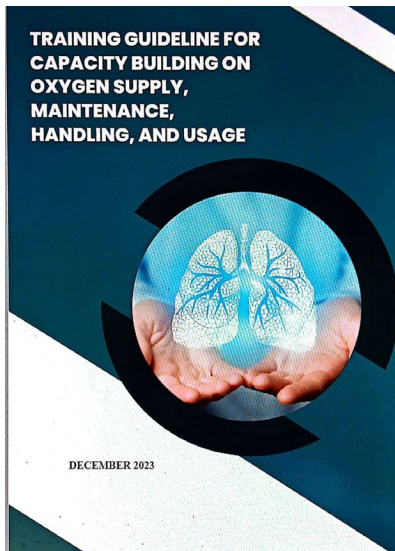
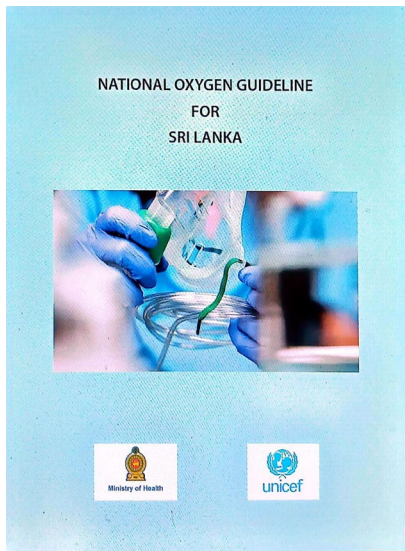
UNICEF supported PIB site	Estd pop	Catchment facilities to receive oxygen	
		Base hospitals	District hospital
1 BH Udugama	90,000	2	21
2 BH Thissamaharama	900,000	3	16
3 TH Kehalle	900,000	3	16
4 DGH Awissawella	800,000	2	11
Total	2.69 mn	10	64



Hospitals supply by TH Kegalle oxygen plant



Neonatal advanced life support training including hypoxemia detection and management



Cambodia Case Study

New oxygen plant saves children's lives in rural Cambodia | UNICEF Cambodia

- Oxygen plant installed at 16 Makara Provincial Hospital, Preah Vihear Province, to treat patients with pneumonia, COVID, and other respiratory diseases
 - Provincial child mortality rate (79 / 1,000) higher than national average (16 / 1,000)
 - First oxygen plant in the province; nearest facility with oxygen therapy 4 hours away
- Procurement and distribution of additional oxygen therapy supplies for all 35 oxygen plants in public hospitals in Cambodia, including oxygen concentrators, patient monitors and other essential accessories
- Training of oxygen plant operators



“I think we will see much better outcomes, particularly in situations where we have to intervene, as with some Caesarian sections. Every second can count when it comes to oxygen, so I’m certain this oxygen plant will save lives.”
- Kan Phirun, nurse and oxygen plant operator

Common Challenges in Oxygen Systems Strengthening across South Asia

National oxygen guidelines, Oxygen training materials and an oxygen dashboard were developed. But introduction of all three components across the country has not happened. It is still **challenging to establish a system** and identifying necessary **funding sources** for the same.

- Sri Lanka

Sustainability issues. Due to the government changes, there is a **gap in the leadership** of the Ministry of health and family welfare and also all the operation plans are on hold.... The support includes the **capacity building of biomedical technicians**, who are mainly responsible for regular and on-call maintenance of all medical devices within the health facilities. However, due to **recent funding cuts**, these activities are put on hold as well.

- Bangladesh

Sustainability remains challenging—insufficient **maintenance** budgets, limited rural vendor networks, and **quality monitoring gaps** persist. While functionality improved to 95-100% in supported facilities, systemic infrastructure weaknesses continue threatening long-term oxygen security nationwide.

- Nepal

Sustaining oxygen systems in Afghanistan faces multiple challenges, including an acute **shortage of biomedical engineers and technicians** compounded with... **[u]nreliable power supply, complex logistics**, and delays in spare part delivery.... Additionally, a **lack of clear ownership and accountability** at system levels leads to poor oversight, ultimately compromising critical care delivery.

Lessons Learned and Recommendations

Takeaways:

1. Embed a systems approach from the beginning of emergency response
2. Integrated support: Equipment, training, and maintenance that are contextually adapted
3. Integrated management of oxygen assets with other medical equipment and supplies (e.g. CCE, SNCUs, waste management)
4. Evidence-based planning and implementation – landscape analysis, build integrated information systems
5. Local capacity building
6. Leadership and ownership of national and local authorities
7. Strategic global partnerships, such as GO2AL, for advocacy, technical assistance, and resource mobilization
8. Availability and use across the continuum of care (e.g. PHC, referral transport)

Investment case

Costs and cost-effectiveness

- Closing the gap will require **\$6.8bn** and **\$34bn** over the next 5 years
- **Comparable to other vital interventions** such as vaccines and breastfeeding in low- and middle-income countries
- Each dollar invested delivers estimated **1.5 DALYs** averted
- Estimated to cost **\$168 / DALY** averted in low- and middle-income countries, compared to **\$23** in highest-burden countries

Embed a Systems Approach, even in low-income settings

- Considering all **systems components** and ensuring **sustainability** from the beginning, addressing inefficiencies, and ensure crisis interventions are transformed into long-term benefits for health systems and populations.
- Policy, evidence-based planning, investment case development, health systems, health worker capacity building, operations and maintenance, quality improvement, and financing for programmatic use are all critical



Pandemic Preparedness

Response: Proves vital in managing outbreaks; integral to global health

Strategy: Strengthening oxygen systems globally to prepare for and respond to future pandemics.

SDGs

Contributing to achieving **seven of the nine health-related SDGs**, especially for maternal and child health.

Investment case covers **1.5 billion people** overall, including 331,000 people in low-income countries (Global Oxygen Investment Case, 2021)

Investment in oxygen systems **significantly reduces global-based pneumonia mortality in children under five**. (Lam, F., Stegmuller, M., 2021)

Thank you

