Strengthening Biomedical Engineering Capacity for Sustainable Oxygen Systems: Lessons from CHAI's National Engagements in Nigeria

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Background:
Despite increased investment in oxygen infrastructure across Nigeria, system fragility persists due to limited technical capacity. Biomedical engineers (BMEs) are vital to ensuring sustainable oxygen delivery but remain undertrained and poorly integrated. Strengthening BME capacity presents a critical, underutilized opportunity to improve oxygen system resilience across all levels of care.

Methods
From 2018 to 2024, CHAI partnered with Nigerian governments to institutionalize BMEs within the oxygen ecosystem. Interventions included developing a nationally endorsed curriculum for PSA plant maintenance, training over 790 BMEs, including 30 master trainers, developing SOPs and a national Code of Practice, establishing peer learning platforms, and embedding BMEs in governance and routine performance review structures.

Results
Post-training assessments showed a 55-percentage point increase in technical knowledge among over 200 BMEs. States reported significant improvements in PSA plant functionality, with uptime rising from 55% to over 85%, due to BMEs' enhanced ability to perform routine maintenance and basic repairs. Subnational adoption of SOPs and the national Code of Practice has standardized safety, maintenance, and reporting protocols. BMEs are now formally engaged in state-level Technical Working Groups and Quality Improvement Teams, reinforcing quality assurance and integration into broader health systems. Moreover, federal and partner-led efforts are enhancing PSA plant performance monitoring across all tiers of care, including primary healthcare facilities, contributing to more reliable and equitable oxygen delivery across the country.

Conclusion
Oxygen system sustainability relies not only on infrastructure but also on a skilled and institutionalized biomedical workforce. CHAI's approach—anchored in training, peer learning, and governance integration—demonstrates that targeted capacity building can drive meaningful improvements in oxygen service delivery. Although national PSA monitoring systems are still developing, this experience offers a replicable model for embedding BME leadership in health system strengthening efforts and advancing oxygen system resilience at scale.