Improving newborn and pediatric quality of care by strengthening access to safe use of oxygen, pulse oximetry, and infection prevention and control measures

LIBERIA’S EXPERIENCE

Context

Despite some progress, the burden of under-five deaths in Liberia remains high. According to the 2019-2020 Liberia Demographic and Health Survey (LDHS), neonatal mortality has increased to 37 deaths from 26 deaths per 1,000 live births in 2013. Under-5 mortality has stagnated at 93 per 1,000 live births, a slight decrease from 94 per 1,000 live births in 2013. These highlight the urgent need to improve not only access but also the quality of care (QoC) around the time of birth, in the neonatal period, and in pediatric care.

Between October 2020 and June 2021, UNICEF and the Ministry of Health (MoH), with financial support from USAID, collaborated with James N. Davis Junior Memorial Hospital in Paynesville, a suburb of Monrovia, to improve the quality of newborn and pediatric QoC with a focus, triggered by the current COVID-19 context, on strengthening access to and safe use of oxygen, and infection prevention and control.

Oxygen therapy in Liberia

Oxygen is an essential treatment and, in Liberia, where major causes of child mortality include birth asphyxia, neonatal infections, and pneumonia, the availability of safe and timely oxygen therapy has the potential to significantly improve the health outcomes of mothers, children, and newborns. However, gaps have been found across the health system, including lack of biomedical equipment and supplies, inappropriate health facility infrastructure and set-up, lack of properly trained human resources for health, and an under-funded health sector. These gaps have been further exposed with the onset of the COVID-19 pandemic, creating a sense of urgency to scale oxygen systems with the opportunity to build long-lasting impact for maternal, newborn and child health (MNCH).

The first comprehensive assessment of oxygen delivery capacity and oxygen systems in Liberia, conducted in 2020, concluded that out of 53 assessed health facilities only 51% could be considered “access points” of basic oxygen therapy. Oxygen concentrators and cylinders are the key oxygen sources in Liberia. Only 3 of the 6 existing Pressure Swing Adsorption (PSA) plants in the country were functional, and the assessment found that only 60%

1 Liberia Institute of Statistics and Geo-Information Services (LISGIS), Ministry of Health (Liberia), and ICF. 2021. Liberia Demographic and Health Survey 2019-20. Monrovia, Liberia and Rockville, Maryland, USA: Liberia Institute of Statistics and Geo-Information Services (LISGIS), Ministry of Health, and ICF.

2 A facility was deemed an access point for oxygen therapy if it had at least 1 trained provider, 1 pulse oximeter, either a functional concentrator and reliable electricity or a cylinder and assembly unit, and at least one delivery interface.
of facilities had at least one functional concentrator and refill and transportation of cylinders was too expensive to be a reliable source of medical oxygen. Of the assessed facilities, 74% had at least one doctor and 62% at least one nurse anesthetist. Even among existing staff, many lacked capacity and knowledge on diagnosis of hypoxemia and safe delivery of oxygen. Similarly, equipment and supplies such as pulse oximeters and consumables like oxygen delivery interfaces were commonly unavailable or in insufficient quantities. The assessment found that oxygen delivery interfaces for children and neonates such as nasal cannulas, venturi masks, and resuscitation bag-masks were less commonly available than for adults. There were insufficient quantities of personal protective equipment (PPE) and Infection Prevention and Control (IPC) capacity.

**Efforts to improve quality of care**

The 2014 Ebola Virus Disease outbreak highlighted the need to incorporate QoC initiatives into the Liberian health system. As a result, a Quality Management Unit was established in 2015 under the MoH to provide strategic and programmatic direction. The unit spearheads Quality of Care and Quality Improvement with a focus on IPC to prevent infections of health care workers, patients, and in communities at large.

In 2017, the Liberia National Health Quality Strategy 2017-2021 (NHQS) was developed to improve capacity across the different tiers of the health system and provide quality health services. The NHQS outlines the objective to establish a quality governing structure at all levels, which includes creation of a Quality Management Team (QMT) at facility level 3. Facility-based QMTs have been established in all health facilities; however, the majority of these have been dormant due to lack of follow up and mentoring by the national and county quality management teams, who are often lacking resources for operational costs. At the national level, the Quality Management Unit is currently working to select priority indicators for QoC in health care including MNCH.

**COVID-19 in Liberia**

While, to date, the COVID-19 pandemic in Liberia has been relatively mild, the country experienced significant disruptions in health services, with 75% of urban health facilities reporting service disruptions in November 2020 and 25% in February 2021 across key reproductive, maternal, newborn, child health and nutrition services. The major driver of the decrease in health service utilization was a perceived lack of essential supplies in the facilities, followed by patient mistrust, uncertainty, and fear of COVID-19. With the lifting of restrictions on movement, provision of PPE as well as capacity building on the continuation of essential health services and the introduction of vaccines, most services have returned to pre-pandemic levels.

**James N. Davis Junior Memorial Hospital (JDJ)**

James N. Davis Junior Memorial Hospital (JDJ) is a secondary referral hospital focusing on MNCH with an estimated catchment population of 275,000 and a capacity of 67 beds, including 47 for newborns and children.

A baseline assessment carried out in October 2020 to understand the specific issues around oxygen and IPC measures for newborns and children identified vast needs to ensure access to basic oxygen therapy and to improve staff capacity. No staff had been trained in oxygen therapy and the hospital’s only pediatrician had recently been transferred from JDJ Hospital to another facility resulting in a large human resource gap. The last training in
newborn resuscitation was done in 2018 and the last IPC training, despite the onset of COVID-19, was done in 2017. The hospital had a severe shortage of oxygen equipment – no functional oxygen concentrators, no oxygen analyzer, no functional humidifiers, no functional flow splitters and only one adult size pulse oximeter circulating between departments based on need. In terms of oxygen therapy consumables, the hospital had few pediatric and neonatal nasal prongs and catheters which were being reused. The hospital relies on oxygen cylinders delivered from a nearby oxygen plant as its main oxygen source. There were 14 functional cylinders available, but the hospital regularly struggles to fund the refill of the cylinders which results in frequent unavailability of sufficient quantities of oxygen. Although the hospital is connected to the public power grid, the power supply is unstable with daily power disruptions. Power is estimated to be available an average of 6-12 hours daily. The hospital has two generators but the high cost of fuel to keep them running during all power outages severely constrains the access to power.

Key actions

**Strengthening partnerships for quality of care**

Efforts were coordinated in close partnership between the MoH, UNICEF, and JDJ Memorial Hospital. The engagement of the national level QMT for enhanced care for service providers and patients supported the collaborative efforts with the MoH and the hospital. A partnership with Médecins Sans Frontières (MSF) facilitated the delivery of quality services for newborns and children by providing peer learning sessions.

Through this initiative, the facility based QMT at JDJ Memorial Hospital was reactivated and received orientation and training by the MoH Quality Management Unit. The QMT began holding monthly meetings, providing a platform for QoC assessments and improvements in the hospital. A community leader was invited to join the QMT to strengthen the linkages and feedback loop between the community and the hospital. A desktop computer was provided to the hospital to strengthen data entry, analysis, and reporting with the aim of facilitating evidence-based decision-making and tracking of progress against selected indicators.

**Infrastructure and equipment**

Leveraging additional resources including from the COVID-19 response, MoH and UNICEF provided a total of 13 oxygen concentrators to JDJ Memorial Hospital. Funding was provided to ensure sufficient fuel for the hospital’s generator during power outages as well as to refill oxygen cylinders as an alternative oxygen source. As a result, since January 2021, JDJ Memorial Hospital has had uninterrupted oxygen access and capacity to supply at least 45 beds with oxygen, increased from 31 beds with unstable supplies at baseline. In the long term, UNICEF is supporting a more sustainable, cost effective, and efficient delivery of power through the installation of solar power in the hospital. As part of strengthening routine health services, funding support from other donors is being considered to build on the gains at JDJ Memorial Hospital.
Memorial Hospital. Provision of drugs and medical supplies continue to be part of the support.

**Capacity building**
To address the identified training gap among the health care workers, capacity building through face-to-face and e-learning was a main priority, supported by a pediatrician consultant who was based at the hospital three days a week. Activities included:

- continued medical education for all clinicians (N=135), focusing on Emergency Triage Assessment and Treatment (ETAT) and standard case management of perinatal asphyxia, neonatal sepsis, acute gastroenteritis, pneumonia, and bacterial meningitis.

- e-learning, together with the hospital’s medical director for all clinicians (N=135) using tablets equipped with educational apps and videos which remain at the hospital to facilitate future e-learning as well as self-learning by hospital staff. Topics covered included post abortion care, hypertension in pregnancy, normal labour and birth, postpartum hemorrhage, manual removal of the placenta, maternal sepsis, neonatal resuscitation, and newborn management. The components on pediatric care were addressed through integrated management of neonatal and childhood illnesses (IMNCI) modules.

- training of hospital staff (n=264), both clinical and non-clinical, on IPC and transmission-based precautions.

- onsite mentoring and coaching focused on oxygen therapy delivery, ETAT, COVID-19 case management, and IPC measures.

- peer-training at the nearby MSF hospital where selected JDJ staff (N=16) were trained in safe oxygen delivery and IPC.

- biomedical technician training of an engineer from JDJ Memorial Hospital for two-weeks at the MSF hospital, to learn proper maintenance of oxygen equipment.

**Decentralizing capacity and strengthening timely referral**
JDJ Memorial Hospital is a referral hospital, with a high number of referrals coming from surrounding primary health care clinics. It is not uncommon that patient referrals are late due to lack of recognition of danger signs and weak referral systems. Nine clinics with high number of referrals to JDJ Memorial Hospital were identified, and clinicians from these facilities were invited to attend the e-learning training at JDJ hospital to build capacity in timely recognition of danger signs and neonatal resuscitation.

Pre- and post-tests were administered to participants to determine the knowledge at baseline and post-training. All participants gained substantial knowledge, with an average increase of 87% in test scores (minimum increase in knowledge was 46% and maximum increase 167%).

**Death reviews**
A system for death reviews was established at JDJ in compliance with the mandate from the MoH for timely review of every maternal and neonatal death within 48 hours during weekdays and 72 hours on weekends. This is a routine activity across the country for all maternal and neonatal deaths. The deaths are reported and reviewed by a facility-based team. The reviews are led by the Medical Director, and a panel formulates recommendations and action points which are followed-up on by the County Health Team. All deaths occurring during the period of this initiative were reviewed (38 deaths, including three maternal deaths, 33 neonatal deaths plus two neonatal deaths reviewed retrospectively). However, some ongoing challenges include finding the time to conduct the death reviews with all necessary team
members attending and expanding the reviews to include review of pediatric deaths. Moving forward, this system will need to be further strengthened.

**Impact**

Reliable supply and capacity building in safe oxygen use ensured that 99% of newborns and children in need now receive timely oxygen therapy. Capacity development of referring facilities improved timely referral of children in need of high impact interventions, increasing the number of children who received adequate treatment. Oxygen therapy is now routinely recorded at JDJ Memorial Hospital.

During the period of implementation, 211 children (120 neonates and 91 children under five) were admitted, of which 108 (51%) required and received oxygen therapy (98 (91%) were neonates and 10 (9%) were children under-five).

**Lessons learned**

1. Strong collaboration with MSF, JDJ Memorial Hospital, and the central MoH ensured ownership and overall framing of the initiative as quality improvement.

2. Onsite mentoring and e-learning provided real time support for health care workers, who were in turn motivated to provide better quality care. Peer learning for clinicians and biomedical technician with a nearby MSF hospital created new linkages and opportunities.

3. Improved tools and capacity to deliver care resulted in increased uptake and utilization of services and better health outcomes.

4. Death reviews provided a platform to identify areas that need improvement and recommend actions to improve health outcomes.

5. The reactivation of the Quality Management Team at JDJ Memorial Hospital created a platform for key personnel to provide leadership in monitoring and implementing quality services in the facility. Strong leadership by the QMT lead (the medical director) is needed to ensure the team remains active and motivated. Identification of motivated QMT members to support the lead to ensure timely meetings with clear direction and monitoring of action points will be helpful as the lead is likely to have competing priorities at times. Similarly, regular monitoring and guidance by the central level Quality Management Unit proved necessary to motivate and guide the JDJ QMT in initial meetings.

**Sustainability and next steps**

UNICEF will continue to work with the Quality Management Unit to strengthen the QMT at JDJ Hospital and support the hospital to implement maternal, newborn and pediatric QoC standards and identify additional priority areas for quality improvement.

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