The pulse oximeter, a tool to introduced in the Integrated Management of Childhood Illness (IMCI) in West Africa

The AIRE project (Improving the Diagnosis of Respiratory Distress in Children) has demonstrated that low blood oxygen level (hypoxemia) is a significant factor of mortality in children under five in West Africa. The routine use of pulse oximeters in primary health centers is vital in identifying children with hypoxemia quickly and refer them to a hospital that provides oxygen therapy. This strategy is well-accepted, easy to deploy and to integrate into IMCI consultations. Scaling up pulse oximeters can save lives, if the necessary means to organize hospital referrals and emergency access to oxygen therapy are provided.

Introduction

The pulse oximeter: an effective tool to improve the management of childhood illnesses.

In West Africa, hypoxemia (low blood oxygen level) can be life-threatening due to unreliable diagnostics and low access to oxygen, mainly when associated with children under-five common illnesses.

Currently, the diagnosis of respiratory distress in primary health care centers (PHCs) is based solely on clinical signs, which can delay proper care. The pulse oximeter (PO) is an inexpensive, easy-to-use, and reliable tool to detect hypoxemia. In West Africa, PO use is almost non-existent in PHCs and remains low in hospitals.

The use of the PO in PHCs: lessons learned from the AIRE project.

The WHO guidelines for IMCI revised in 2014 recommend to use POs at the first level of health care for children with respiratory illness, and oxygen therapy for children with severe hypoxemia (oxygen saturation below 90%). Until recently, little evidence was available to motivate PO use in PHCs.

Since its launch in 2019, the AIRE project has introduced and evaluated the routine use of POs in IMCI consultations in primary health centers in Burkina Faso, Guinea, Mali, and Niger.

This policy brief presents the lessons learned from the AIRE project and offers recommendations for stakeholders committed to reducing the mortality of children under-five.

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Key messages

- The integration of the pulse oximeter during IMCI consultations is **a well-accepted and easy to implement** strategy in primary health centers in West Africa.
- The pulse oxymeter reassures health workers in their diagnosis and referral decisions and increases caregivers trust in health workers.
- In primary health centers in all 4 countries, among children under five years of age seen in IMCI consultations and eligible for PO use, **approximately 1 in 10 cases had hypoxemia** (between 7.6% and 13.3% of children had oxygen saturation of 93% or less).
- Among the children diagnosed as severe cases (according to the IMCI classification) who died, **between 37.5% and 64.2% had hypoxemia.**
- Scaling-up pulse oxymeter integration in primary health centers also requires revising IMCI, training health workers, and ensuring sufficient investment to guarantee rapid referrals to the hospital and quality access to oxygen.

Approach

The AIRE project was implemented in 202 PHCs and eight referral hospitals. The project's research, based on qualitative and quantitative studies, assessed its implementation, acceptability, feasibility, and the effects of POs on the health of under-five children.

The data presented in this note are from 16 PHCs (research sites) in West Africa. The project followed the health evolution of nearly 2000 children suffering from a severe illness and assessed their health status on the 14th day after their first consultation at the PHC.

Results

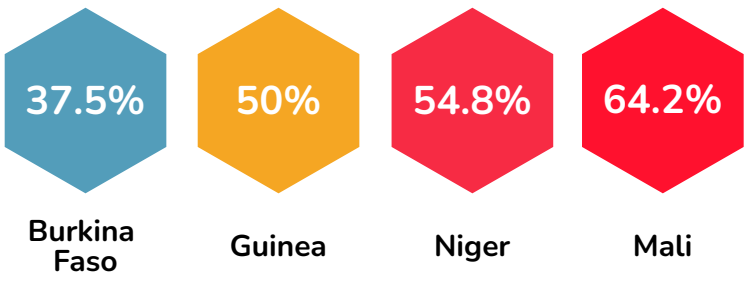
Hypoxemia is common among children under care in PHCs...

- Among nearly 2000 under five children identified **as "severe cases" through IMCI using POs**, the **proportion of children with hypoxemia was 18%** (6.6% severe hypoxemia, 11.4% moderate hypoxemia).
- Pneumonia was the main **pathology associated with hypoxemia** followed by malaria, anemia, and severe acute malnutrition.
- The prevalence of hypoxemia in **children with severe respiratory illness was 21.1% and 14.1%** for those **with non-respiratory illness.**

...and hypoxemia represents a significant risk of death.

- **Moderate hypoxemia increases the risk of death by 2.7-fold** in severe cases, **and severe hypoxemia by 4.3-fold**.

hypoxemia proportion among death of severe cases



Routine use of the pulse oxymeter facilitates referral of children with hypoxemia.

- After 4-6 months of project implementation, POs were used in over 90% of the IMCI consultations at the participating PHCs.
- Between 70% and 100% of children with severe hypoxemia were referred effectively.
- The pulse oxymeter helps with referral decisions. The study has shown that children diagnosed with severe hypoxemia as measured by pulse oxymeter, are referred more often than severe cases without hypoxemia.

Health workers and children's caregivers appreciate the pulse oxymeter.

After several months of use, over three-quarters of health workers (75% to 100% depending on the country) have adopted the pulse oxymeter. They find many benefits, such as ease of use and increased confidence in their diagnosis and referral decision.

"The referral decision is faster now. Before, you had to keep, monitor, and observe the patient before you could refer. It delayed treatment. With the PO it's direct. If you measure and you find that it is too low, you explain to the parents and you refer."

The main objection to the pulse oxymeter is the additional time it takes to use it during consultation, especially when the child is agitated or during busy periods at the primary health center.

"Yes, I like to use this tool, it's good as long as it helps me! [...] But there are periods, especially during peak malaria, when you find yourself with 30 sick people to consult, that's when it becomes a bit difficult, otherwise, there is no problem."

Challenges to scaling up the PO

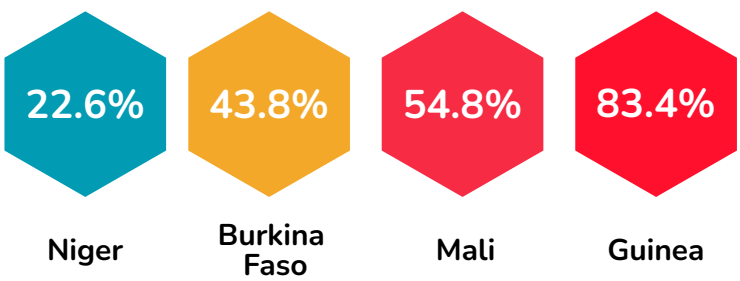
The sustainable use of the pulse oxymeter by health workers.

- **Incorporating the pulse oxymeter into the IMCI algorithm would promote its sustainable use at the primary health center**. Thus the tool would be systematically used during consultations.
- To facilitate PO integration at the PHC level, **health workers need to update their knowledge of IMCI**. The cost of training and re-training health workers in IMCI could represent the largest part of the budget needed to scale up the use of the PO at PHCs.
- According to the evaluation of the study conducted by Terre des hommes in Burkina Faso since 2014, **the digitization of the IMCI protocol is proving to be a relevant complementary strategy for improving the quality of diagnostic and prescription practices in PHCs.**

Early case management and quality care at the PHC and in hospitals.

- The positive effect of the PO on reducing infant mortality at PHC **will be lost if children diagnosed with severe hypoxemia cannot be transferred quickly to the hospital or if no oxygen is available there.** Hospital referrals are a challenge that needs to be addressed as a priority: **a significant proportion of severe cases do not reach the hospital.**
- Except for Burkina Faso, where all cases of severe hypoxemia were managed in hospitals, **8.3% to 20% of children with severe hypoxemia were cared for at the PHC**. Among severe cases, a significant proportion of deaths occurred before arrival at the hospital.

out-hospital death among severe cases



Among the **roadblocks to early case management and appropriate treatment** of children with hypoxemia (and more broadly of severe cases), we observed:

Late recourse to health services and alternative care pathways.

- Children seen in consultation in PHCs arrive **on average two or three days after the onset of symptoms**, which suggests delayed recourse to health care services.
- **Between 16% and 86% of children admitted to the hospital did not come through a PHC.** Of these, 18% to 65% had already taken medication.
- Except for Burkina Faso, where healthcare is free at the PHC, **medical expenses for severe cases** at PHCs (from 3,330 to 5,500 CFA) and hospitals (from 10,000 to 30,000 CFA) can partly explain the delays in using health facilities and the choice of alternative care pathways.
- **Limited availability of ambulances**, especially in rural areas, and transport costs are also roadblocks to the referral of severe cases.

Access to oxygen therapy remains inadequate for children with hypoxemia.

- Hospital staff are not routinely trained in oxygen therapy and PO use.
- Prior to project implementation, there was **limited availability of POs and oxygen therapy** in district hospitals.
- Access to oxygen therapy for children with severe hypoxemia remains insufficient.

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Recommendations

1. Support countries in the sub-region in mobilizing funds to implement the introduction of pulse oximeters at the PHC level (training of health care workers and availability of the tool) and to improve sustainable and safe access to oxygen.

2. Mainstream the routine use of the PO into IMCI at the PHC:
- Integrate the PO into PHC equipment lists, standards, and norms
- Revise the IMCI algorithm and training modules by adding the PO
- Promote the use of PO also for children under five years of age with non-respiratory diseases

3. Ensure proper use of IMCI at the regional level through:
- Updating health workers on IMCI
- Digitization of the IMCI protocol to improve the quality of consultations
- Effective post-training supervision and support mechanisms (such as quality improvement or coaching at the health district level)
- Introducing PO integrated IMCI in health workers' basic training

4. Improve access to a transportation system for hospital referrals of severe cases through:
- Free hospital referrals for children under five
- Availability of ambulances, if possible equipped with oxygen, in the health districts
- Support for community-based mechanisms to transport severe cases

5. Ensure oxygen availability and proper use in hospitals through:
- Training hospital staff in the use and maintenance of POs and oxygen therapy equipment
- Availability of POs in pediatric units
- Better assessment of oxygen needs at the national level, and sufficient resources allocated to ensure a sustainable and sufficient oxygen supply system

6. Strengthen, intensify, and improve community communication strategies to:
- Encourage earlier recourse to health care services
- Limit the risks associated with self-medication
- Increase adoption of preventive practices to combat pneumonia, malaria, and malnutrition

preliminary version

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