RESULTS FOR DEVELOPMENT

IMPACT BRIEF

# Reducing Child Mortality in Tanzania by Increasing Access to Pediatric Pneumonia Treatment

2014-2025

## OVERVIEW

### Pneumonia — the leading cause of death in children under five in Tanzania

Lowering pneumonia-related mortality is key to achieving the Government of Tanzania's (GoT) goal of reducing overall child mortality by 80% by 2030.[1] Since 2016, Tanzania has expanded access to the first-line treatment for childhood pneumonia, amoxicillin dispersible tablets (Amox DT)[2], **bringing life-saving care to more children**.

*Dr. Edwin Mollel (right), Deputy Minister of Health, receives the final donor-funded consignment of Amox DT from Gilbert Mateshi (left), R4D Program Director and Country Manager, marking the full transition of Amox DT procurement to the Government of Tanzania after years of partnership to expand access to childhood pneumonia treatment.*

### Evidence-informed market shaping interventions expanded access to pneumonia treatment

In 2014, the GoT updated Tanzania's clinical guidelines to make Amox DT the first-line treatment for childhood pneumonia, in line with the World Health Organization's (WHO) guidelines, and added the product to the Essential Medicines List. However, according to available data sources in 2015, pediatric amoxicillin[3] was among the most commonly stocked out child health medicines in public health facilities, leading to inconsistent availability and low levels of access to pneumonia treatment.[4] Multiple constraints on the GoT's health budget at the time meant there were limited resources available to procure the necessary quantities of Amox DT to meet demand across all tiers of the public health system. While UNICEF provided initial support to meet demand by procuring the first batches of Amox DT starting in 2015 (totaling 16 million tablets), after project funding ended in 2016, the GoT was again faced with imminent stockouts.[5]

While ensuring that Amox DT is consistently available in health facilities is necessary to lower child deaths from pneumonia, it is not sufficient. Mortality reduction requires the rational use of Amox DT for pneumonia, as well. This largely depends on providers comprehensively following the Integrated Management of Childhood Illness (IMCI) steps to diagnose pneumonia in children and then appropriately prescribing Amox DT for treatment. In 2016, there was no robust data measuring how accurately providers were diagnosing pneumonia patients and prescribing treatment, creating a large evidence gap for policymakers.

## KEY ACTIVITIES AND ACHIEVEMENTS

To address the inconsistent availability of Amox DT, Results for Development (R4D) and the GoT, along with support from key partners, developed **a holistic market shaping strategy** in 2015 that included several programmatic activities and evidence generation activities that led to improved accessibility and rational use of Amox DT.

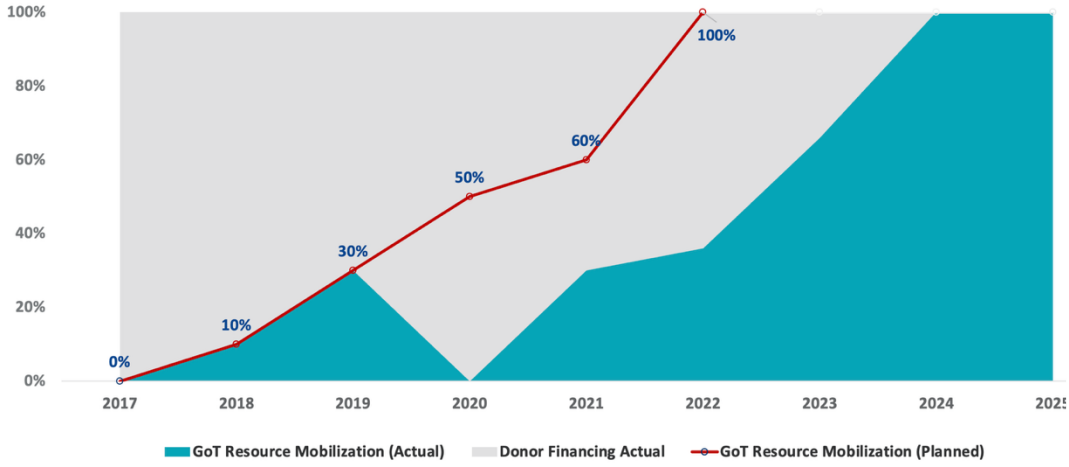
### *Financing: Amox DT funding has fully transitioned from being 100% financed by donors to now fully financed by the GoT through domestic resources*

The market diagnostic assessment conducted at the beginning of the program uncovered that there was no committed funding source for Amox DT and the imminent funding cliff created a high risk of nationwide stockouts. To address this urgent gap, R4D, with the support of its donor, GiveWell, mobilized catalytic, time-limited donor financing while simultaneously supporting the GoT to identify financing mechanisms to ensure long-term sustainability. **Administering catalytic financing** to procure Amox DT, alongside the GoT's complementary financing, **resulting in18.8 million courses of treatment** through 2017 to 2023 before fully transitioning to domestic resources funding in 2024.

#### *1. Establishment of a co-financing agreement between MoH and R4D*

R4D worked closely with the MoH to develop a 5-year co-financing agreement that required incremental increases in GoT co-financing year-over-year complemented by decreasing levels of donor funding for Amox DT, aiming to have the GoT fully and sustainably finance Amox DT needs by the end of 2022. However, the COVID-19 pandemic significantly disrupted progress placing immense pressure on domestic health budgets to effectively respond to the pandemic. Therefore, in 2020, the co-financing agreement was put on a temporary pause, with the GoT contributing 0% to the financing of Amox DT. During this period, R4D worked with the donor, who remained flexible and topped up to cover 100% of Amox DT procurement needs, ensuring continued availability and uninterrupted services (Figure 1).

*FIGURE 1: Amox DT Financing Journey (2017-2024)*



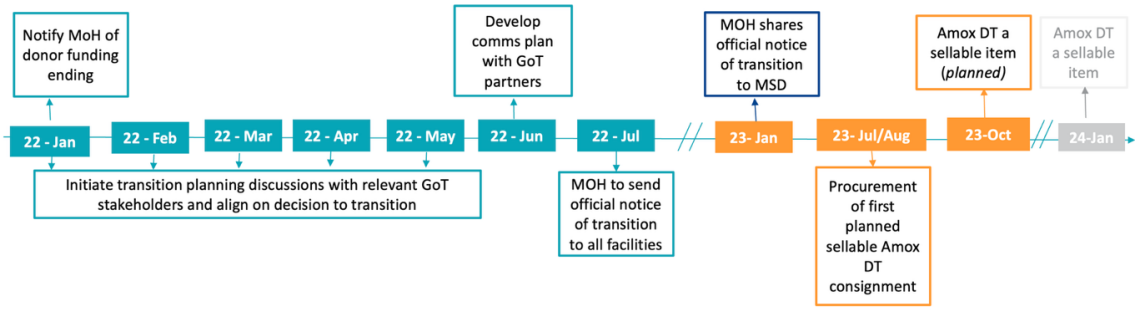

After the peak of COVID-19, the GoT refocused its efforts on the co-financing agreement, and incrementally achieved its goal of funding 100% of the country's Amox DT needs through domestic resources by 2024

Efforts to achieve sustainable domestic financing for Amox DT spanned over 7 years, extending beyond the originally planned 5-year timeline

#### *2. Development and successful implementation of the transition plan from donor funding to domestic funding*

To ensure a smooth transition from donor funding to domestic funding, R4D and the GoT developed a transition plan with a focus on ensuring timely and clear communication with key stakeholders (Figure 2).

*FIGURE 2: Transition Plan*

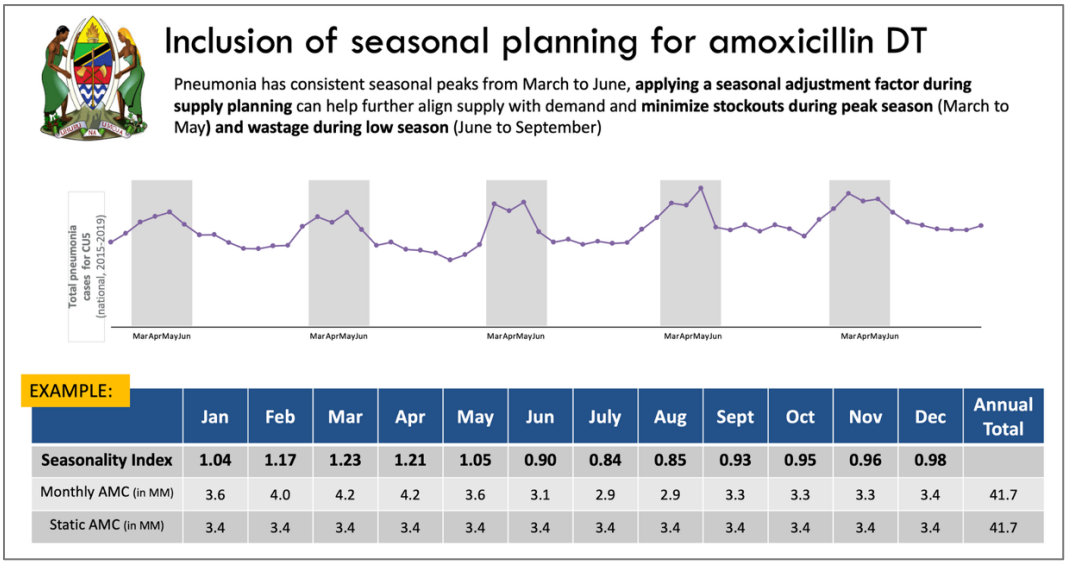


***Supply Chain:* Quantification and supply planning systems have become more robust, automated and country-led improving forecasting accuracy, creating efficiencies and driving sustainable procurement through the Medical Stores Department.**

### 3. *Improved forecasting methodologies by analyzing both consumption and morbidity data to estimate demand for Amox DT thereby, strengthening quantification and supply planning methods to more accurately account for needs.*

These improvements led to 177% increase in projected monthly demand over the course of 6 years, from 2015-2021. Additionally, incorporated seasonality into supply planning to minimize stockouts during peak seasons and wastage during low seasons (Figure 3). To enhance sustainability, in 2022 quantification of Amox DT was transitioned to the bottom-up quantification, a national forecasting approach for domestic resources funded essential health commodities

*FIGURE 3: Incorporation of seasonality into Amox DT forecasting*




| | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sept | Oct | Nov | Dec | Annual Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seasonality Index** | 1.04 | 1.17 | 1.23 | 1.21 | 1.05 | 0.90 | 0.84 | 0.85 | 0.93 | 0.95 | 0.96 | 0.98 | |
| Monthly AMC (in MM) | 3.6 | 4.0 | 4.2 | 4.2 | 3.6 | 3.1 | 2.9 | 2.9 | 3.3 | 3.3 | 3.3 | 3.4 | 41.7 |
| Static AMC (in MM) | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 41.7 |

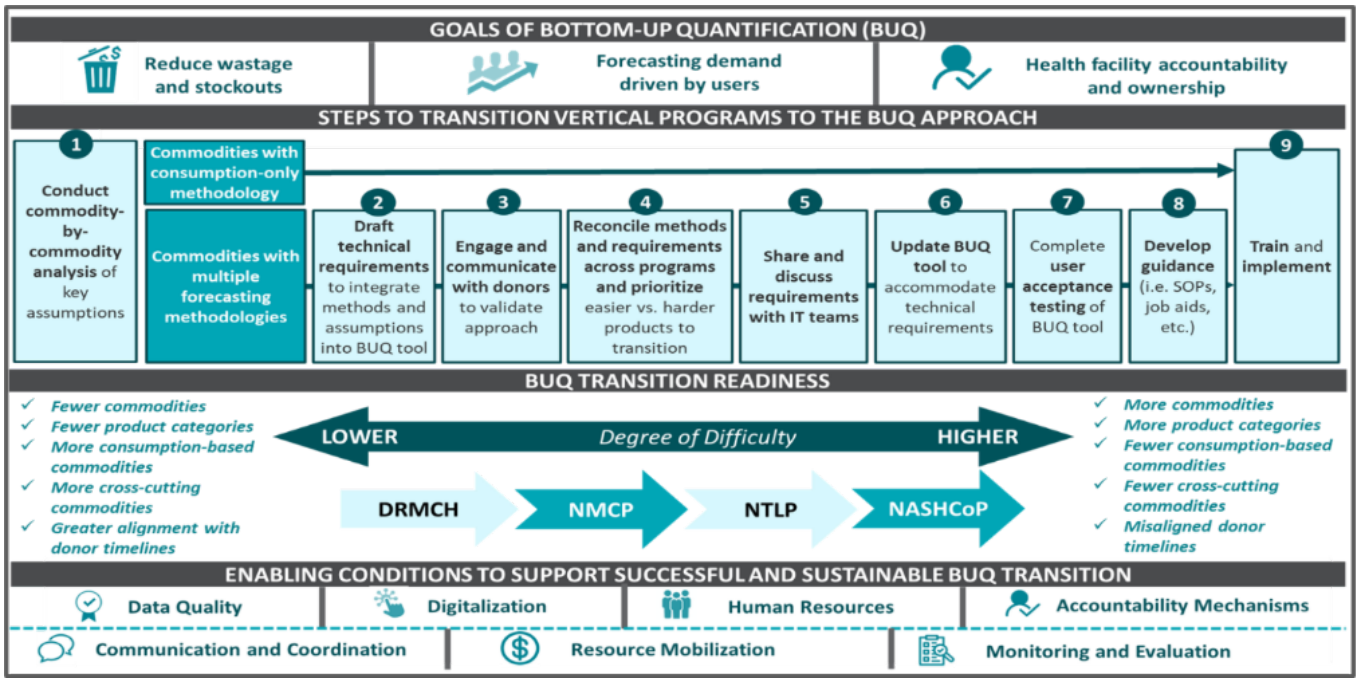
***Similar to malaria, pneumonia prevalence appears to be seasonal***

Pneumonia data collected from health facility patient registers indicates that pneumonia prevalence is seasonal from March to June. The average number of pneumonia cases is 75% higher and the average number of acute respiratory infections (ARIs) is 54% higher during this period than the rest of the year

### 4. *R4D successfully supported the government in developing a transition roadmap to help transitioning vertical program commodities to the bottom-up quantification (BUQ) approach.*

A strategic document designed to guide the MoH and other supply chain stakeholders in the country through a collaborative, well-informed, and adaptive process towards transitioning demand forecasting of vertical program (VP) commodities to a bottom-up quantification (BUQ) approach (Figure 4).

*FIGURE 4: Roadmap to transition VPs to the BUQ approach for demand forecasting*



### 5. *Procurement and supply planning of Amox DT transitioned from an external agency to the national procurement agency, the Medical Stores Department (MSD).*

To reinforce country ownership and enhance the sustainability of procurement processes, responsibility for procuring Amox DT was transferred to MSD in 2017. This transition aimed at strengthening institutional capacity to procure the product beyond the program. Shifting procurement to MSD from an external agency positioned the product to be adapted within routine government supply chain operations, supporting long-term availability and integration into national essential medicines management

### 6. *Improved efficiency and accuracy of supply planning processes by supporting MSD's efforts to transition from manual, excel-based supply planning to a supply planning dashboard with automated supply plan functions.*

MSD had been monitoring its supply plan manually, a time-consuming process that relied on triangulating multiple Excel reports and was prone to errors. The digitization of supply planning introduced a digital tool that integrates multiple data sources, eliminating manual analytics and enabling data visualization for supply planning and commodity management. This improvement once fully adopted to MSD systems will supports better inventory control, reduces stock-outs and minimizes wastage due to expirations

## *Regulatory: Inclusion of Amox DT into key national level policies and country guidelines to enable scale-up and uptake.*

### 7. *An aligned policy environment across public and private sectors ensures that Amox DT is included in the National Essential Medicines List and in clinical guidelines.*

Led by the government of Tanzania, R4D and other partners supported the revision of national policies and clinical guidelines i.e.. the Integrated Management of Childhood Illness (IMCI) Guidelines, Standard Treatment Guidelines, Pediatric Standard Treatment Guidelines, and ADDO training manuals so that Amox DT is recognized as the preferred first-line treatment for pneumonia in children under five years

## *Supply Base: Increased the number of registered Amox DT suppliers from 1 in 2014 to 8 in 2023, with 6 suppliers maintaining their active registration status with the government regulatory authority in 2025.*

### 8. *The program encouraged market transparency and helped incentivize manufacturers to register in-country, strengthening the supplier base and improving supply security.*

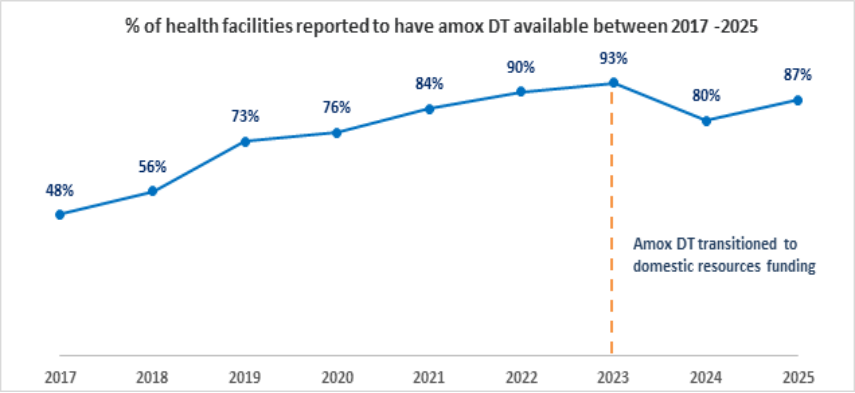
Through gathering market intelligence, conducting market sizing assessments and developing business cases for Amox DT suppliers, various global suppliers were encouraged to registered in the country. A broader pool of registered suppliers not only enhances competition and reduces the risk of stock-outs, but also supports price stability and improves the government's bargaining power. This expansion is critical to ensuring long-term, reliable access and safeguarding continuity of services.

## *Amox DT Availability: Amox DT availability at the health facility level has increased from 48% in 2017 to 93% in 2023.*

### 9. *Through the implementation of a holistic market shaping strategy targeting financing, supply chain, regulatory, and supply base interventions, Amox DT is more widely available for children with pneumonia in public health facilities.*

Throughout the course of 2017 to 2023, the number of health facilities that had reported to have Amox DT available significantly increased by ~ 94% (or 45 percentage points) from 48% in 2017 to 93% in 2023. With slight decrease in availability after fully transitioning to domestic resources to an average of 87% in -2025, suggesting more efforts to maintain the gains made throughout the program (Figure 5).

*FIGURE 5: Amox DT Availability Trends from 2017 - 2025*



## EVIDENCE GENERATION ACTIVITIES AND FINDINGS

As part of the childhood pneumonia market shaping strategy, a few areas for measurement and piloting were also identified. Alongside the ongoing programmatic activities previously outlined, the GoT, R4D and IDinsight* partnered[9] to design data collection activities to monitor progress in availability of Amox DT at frontline points of care and to better understand the current status around the rational use of Amox DT for pneumonia. These activities helped R4D measure the expansion of the public Amox DT market over the course of the past decade, **demonstrating that national level market shaping influences access to pneumonia treatment at frontline health facilities**. R4D's studies also highlighted the continued challenge of expanding private sector access to Amox DT, which has remained limited due to the private sector's continued emphasis on selling Amox OS.

In addition, these evidence generation activities have shown that pneumonia care is about more than just having the product available for dispensing. Public sector providers struggle with the correct diagnosis of pneumonia, raising concerns for anti-microbial resistance (AMR) when they then over-prescribe Amox DT for cases that are likely not pneumonia. Incorrect diagnosis and prescription also distort the consumption of Amox DT, which influences the accuracy of quantification. Giving providers support through clinical mentoring or involving nurses in triage for pneumonia care are promising modes for improved diagnosis and prescription behavior. The following activities provided evidence for these insights about the Amox DT market.

### Evidence Generation Activities:

- ***Health facility and private drug shop surveys:*** A nationally representative survey of 624 public health facilities was conducted in all mainland regions of Tanzania, across public dispensaries, health centers and district hospitals. Additionally, a survey was conducted in a representative sample of Accredited Drug Dispensing Outlets (ADDOs) in the three regions of Kagera, Mtwara and Pwani. Availability and stocking levels of Amox DT and comparator medicines were measured across all surveyed facilities and outlets. These surveys were conducted in March, July and November 2017.

- ***Pneumonia diagnosis and prescription study:*** A clinical study was conducted, examining a sample of 850 CU5 seeking care in 83 public health facilities in Dodoma, Pwani and Tabora regions. The study used lung ultrasound examinations[10] to measure the rate of over- and under-diagnosis of pneumonia as compared with routine diagnosis according to IMCI guidelines. The study also measured over- and under-prescription of pediatric amoxicillin for pneumonia.

- ***Piloting quality of care (QoC) interventions:*** Following focus group discussions, a small-scale pilot of cost-effective, scaleable interventions aimed at improving provider diagnosis and treatment behavior was conducted in 39 public health facilities in Dar es Salaam and Morogoro. The interventions piloted included remote clinical mentoring, clinical mentoring using case studies, mobile messaging and visual aids (in the form of job aids and posters). Interventions to improve ADDO dispenser behavior were also piloted in 15 ADDOs in Dar es Salaam.

- ***Leveraging the know-can-do framework to build on QoC piloting:*** The first set of interventions, as described above, focused on ensuring that providers had the knowledge (know) so that they were capable (can) of appropriate diagnosis. The second round focused at identifying the need to address performance barriers at the facility level. Consequently, an intervention involving triage nurses in pneumonia diagnosis was implemented in nine facilities, following refresher IMCI training

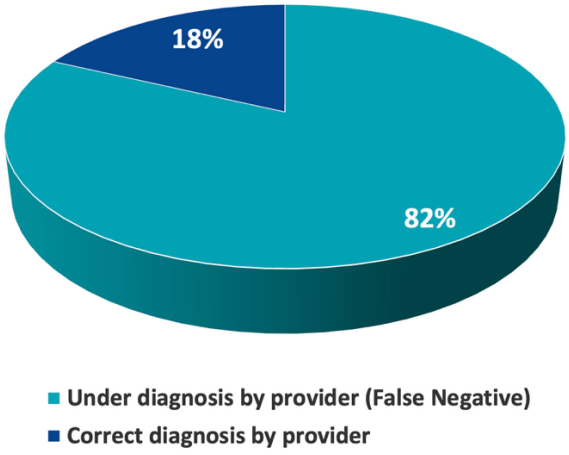
### Evidence Generation — 4 Key Findings:

#### *Key Finding #1: The majority of pediatric non-severe pneumonia patients were under-diagnosed for their illness*

Providers gave a pneumonia diagnosis to only approximately one-fifth[15] of pneumonia-positive CU5 in public health facilities in the three regions where the pneumonia diagnosis and prescription study took place (see Figure 6).[16] This means that an estimated four out of five pneumonia patients, as confirmed by lung ultrasound, received a diagnosis other than pneumonia, reducing the likelihood that they received the medication they needed to treat their illness

*FIGURE 6: Pneumonia Diagnosis Rate CU5*[17]

The **majority (~80%) of pediatric** non-severe pneumonia patients **are under-diagnosed for their illness**




***Key Finding #2: Providers are better at ruling out pneumonia and over-diagnose only a small portion of pneumonia-negative patients.***

In the same study, **an estimated one in ten children without pneumonia (though with respiratory illness symptoms) were given a pneumonia diagnosis**.[18] A common assumption is that providers over-diagnose patients with pneumonia. However, as this finding and the one above show, *under-diagnosis* appears to be the more critical quality of care challenge, with providers often missing a large portion of the pneumonia cases that pass through their facilities.

***Key Finding #3: Providers often skip steps recommended in the IMCI guidelines for diagnosing pneumonia, even when they know the steps they should carry out, suggesting a large "know-do gap"***

Providers conduct clinical examinations19 on 33% of CU5 who present with respiratory symptoms.[20] Therefore, for 67% of children with respiratory symptoms, providers are typically only asking questions to caregivers about their child's illness. Furthermore, although 67% of providers identify that the patient's breaths should be counted for a full minute to diagnose pneumonia, they only perform this assessment for a full 60 seconds, as required by the IMCI protocol, in 7% of cases. The discrepancy between the large percentage of providers who know they should be counting breaths, and the frequency with which they carry out this assessment, suggests an important gap between knowledge and action

***Key Finding #4: Providers are better at prescribing treatment when they have correctly diagnosed pneumonia.***

When providers accurately diagnose patients who have pneumonia, they perform better at prescribing the appropriate medication, with 72% of children in this category receiving a pediatric amoxicillin prescription.[21] Conversely, providers prescribe pediatric amoxicillin to 46% of pneumonia patients who they diagnosed as having illnesses other than pneumonia. This suggests that if providers can reduce their misdiagnosis rates there would be substantial gains in overall treatment coverage rates for CU5 with pneumonia because provider prescribing behavior is more accurate when their diagnoses are correct. As a result of the two types of prescription behavior (correct diagnosis/correct prescription and incorrect diagnosis/correct prescription), about half of all pneumonia patients receive a pediatric amoxicillin prescription.

## KEY LESSONS LEARNED

1. **Strategic use of catalytic donor funding can incentivize governments to mobilize resources and achieve sustainable scale-up.** Catalytic funding played a crucial role in bridging critical financing gaps for Amox DT and ensured continued access to this life-saving product while providing opportunity for the government to identify sustainable funding mechanisms. This approach highlights an effective way to align donor support in filling temporary gaps without duplicating efforts while supporting sustainability through local ownership.

2. **The co-financing agreement between R4D and the GoT and the transition plan played a critical role in facilitating gradual domestic resource mobilization** while ensuring smooth transition and minimum impact on product availability levels.

3. **Commodity financing, while significant, is one element of a healthy market and does not guarantee product access and availability.** As seen with the Amox DT example, despite having sustainable financing sources in place, availability can still a challenge and other key market and supply chain functions must also be an area of focus (i.e. procurement, supply planning, manufacturer selection, etc.)

4. **Embedding an evaluation and adaptive learning approach within programs provides access to rich data in a relatively short period of time**, allowing for data-driven decisions to be made for program design and policy change.

5. **To ensure sustainability, solutions must be embedded within government structures rather than creating parallel systems**; and this works best when government leaders and other change agents are in the driver's seat as they are the ones that are most aware of how to integrate new solutions into existing systems. For example, financing of Amox DT was embedded into direct health facility financing mechanisms, leveraging health facility budgets as a sustainable financing source for Amox DT.

6. **Early and consistent engagement with the government is fundamental to achieving the program objectives**. From the inception, the initiative aligned with national priorities, which enabled a close collaboration with relevant government stakeholders to inform design and implementation. This approach fostered strong government ownership, enabled timely decision-making, and ensured that program strategies were integrated within existing systems. As a result, the program's interventions were context-appropriate, institutionalized, and positioned for long-term sustainability.

7. **Flexibility and adaptability are essential.** The donor's ability to adjust during COVID-19 disruptions allowed the program to stay on track. Beyond pandemic-related challenges, the program also adapted to shifts in government leadership and evolving policy priorities, ensuring continuity through proactive engagement and alignment with national strategies.

8. **Maintaining consistent buy-in from government counterparts requires ongoing communication, responsiveness to emerging needs, and readiness to recalibrate** timelines and approaches.

9. **The Amox DT approach offers a replicable model for other essential medicines.** Its successful transition from donor reliance to sustainable domestic financing demonstrates that embedding solutions within government systems, leveraging catalytic funding to bridge gaps, co-designing transition plans with national stakeholders, and maintaining clear communication are transferable strategies. When adapted to the specific context of other products, these elements can support countries in reducing donor dependency and promoting long-term sustainability and commodity security through domestic resources

10. **Sustainable change takes time.** The Amox DT experience highlights the importance of prioritizing sustainability at the outset, with all activities designed to support this goal — a critical factor in the program's success. Over seven years, Tanzania fully transitioned Amox DT procurement to government funded, offering a model for reducing donor dependency through strategic planning, government leadership, and adaptive execution

## CONCLUSION

The program demonstrates that strategic investments in evidence-based interventions and strong government engagement can strengthen market shaping and supply chain systems — which can accelerate equitable access to life-saving commodities such as Amox DT.

Through sustained collaboration with the MoH and key partners, the program institutionalized key processes and ensured sustainability. Learnings from the program's evidence-generation activities have the potential to strengthen the broader health system beyond pneumonia and child health. Improvements in pneumonia case management accuracy can also enhance provider capacity to diagnose other maternal, newborn, and child health conditions which is essential in improving overall health outcomes. The systems, practices, and partnerships established through this program lay a strong foundation for sustained impact and future scale.

R4D remains committed to supporting the GoT in sustaining and scaling market shaping interventions in the country for broader set of products. Leveraging key lessons learned from this, R4D through its Improving Market Access and Financing for Health (IMAF-H) Project is extending its efforts in expanding market shaping, supply chain capacity building and health financing interventions beyond Amox DT and to the broader RMNCAH product category.

# NOTES

1. Government of Tanzania, Ministry of Health, "Women and Children First: Countdown to ending preventable maternal, newborn and child deaths in Tanzania" (May 2015).

2. Amox DT is also the recommended first-line treatment for childhood pneumonia by the World Health Organization (WHO).

3. Pediatric amoxicillin refers to the two formulations of amoxicillin commonly prescribed for CU5: Amox DT and amoxicillin oral suspension/syrup (amox OS).

4. USAID, "Evaluation of Country-level Constraints in Accessing Financing for the Procurement of Nationally Funded MNCH Commodities," Report (August 2015).

5. R4D procurement tracking data.

6. GoT stakeholders who participated in this effort included the Reproductive, maternal and Child Health (DRMCH) of the Ministry of Health (MoH), President's Office - Regional Administration and Local Government (PO-RALG), Medical Stores Department (MSD), Tanzania Food and Drugs Authority (TFDA) and the Pharmacy Council. Results for Development (R4D) was the primary non-GoT partner
contributing to these efforts. This work was supported by the Bill & Melinda Gates Foundation and Good Ventures.

7. Market shaping is an approach used by many actors across the global health sector to increase access to, and improve rational use of, essential products. Through in-depth market analysis, partners identify barriers to access to health products and implement strategies to reduce those barriers, thereby improving market efficiencies and ensuring that more high-quality products reach their intended users.

8. MoH: Ministry of Health

9. Additional partners participating in the evidence generation activities described here include: National Institute for Medical Research (NIMR), Muhimbili University of Health and Allied Sciences (MUHAS), IDInsight and Economic Development Initiatives (EDI) Limited.

10. Results from a meta-analysis on the use of lung ultrasound showed that it has a sensitivity of 96% and a specificity
of 93% as compared to chest x-ray: Pereda M, Chavez M, Hooper-Miele C, et al, "Lung Ultrasound for the Diagnosis of Pneumonia in Children: A Meta-analysis," *Pediatrics* (2015).

11. Medication is available in a health facility if at least one table of amox DT is available either at the dispensing window or in the stock room of the facility on the day of the survey.
Statistical significance for the difference in availability between Round 1 and Round 3 is indicated with: * p-value
<0.05; ** p-value <0.01; significance for the difference between Round 2 and Round 3 is indicated with: ^ p-value
<0.05; ^^ p-value <0.01 (p-values have been adjusted via the Holm-Bonferroni method).

12. Health facility and private drug shop surveys (2017).

13. The precise numbers are being reviewed and analyzed and will be available in the first half of 2019.

14. Pneumonia diagnosis and prescription study (2017).

15. Pneumonia diagnosis and prescription study (2017). At each facility, one health care provider who was responsible for treating CU5 was randomly selected for the study. Survey interviewer directly observed provider patient consultations and recorded provider diagnosis; CU5 with respiratory symptoms or a respiratory diagnosis taken for lung ultrasound (LUS) examination and LUS result compared to provider diagnosis to determine accuracy; N = 847 CU5.

16. Clinical examination refers to the completion of one or more of the three assessment steps providers should be undertaking when diagnosing a child under five according to the IMCI guidelines: 1) counting breaths, 2) looking for chest in-drawing and/or 3) listening to breathing for sounds of stridor or wheezing.

17. Recording information from the patient registers was a time- intensive process. Rather than record all cases of pneumonia in CU5 in the registers, the data collection team counted the number of cases during one full week of each of the four months prior to the day the survey took place in a facility.
The weekly totals were then extrapolated by multiplying by 4.28 to reach an estimate of the monthly total cases of pneumonia per health facility.

## ACKOWLEDGEMENTS

**This project builds on the experience and expertise of many organizations and individuals working to reduce childhood mortality in Tanzania. R4D would like to thank all collaborators who are part of this project, including the following key partners:**

Ministry of Health (MoH), with special thanks to the Directorate of Reproductive, Maternal and Child Health (DRMCH)President's Office - Regional Administration and Local Government (PO-RALG)

Medical Stores Department (MSD)

Tanzania Medicines and Medical Devices Authority (TMDA)

Pharmacy Council

National Institute for Medical Research (NIMR)

Muhimbili University of Health and Allied Sciences (MUHAS)

IDinsight

Economic Development Initiatives (EDI) Limited

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GiveWell