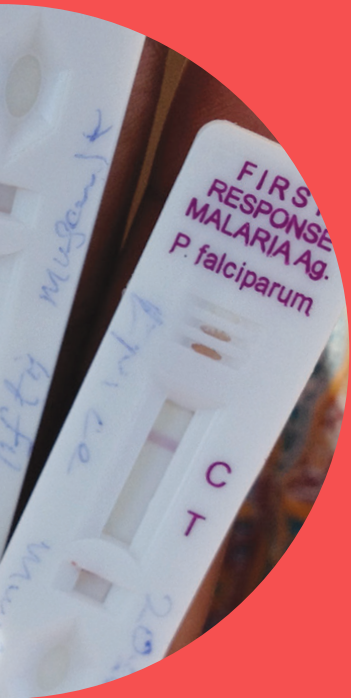


Markets for Malaria

Improving Access to Medicines and Diagnostics

PATH Malaria Learning Series



Making progress against malaria requires collaboration across borders, sectors, and disciplines. PATH engages and connects partners in the public, private, and nonprofit sectors, including country partners such as key ministries (including health, agriculture, science and technology, finance, and others), as well as national malaria programs, to develop, evaluate, and scale tools and strategies to defeat malaria. Our partnership model translates bold ideas into products and strategies and leverages national capacity and enthusiasm in the push toward malaria elimination.

The PATH Malaria Learning Series

The PATH Malaria Learning Series provides concise briefings on the latest evidence in malaria research and science. Each issue provides an overview of important developments in malaria control and elimination and synthesizes results from PATH-supported research.

Acknowledgements

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At PATH, we are committed to developing and evaluating new products and strategies to prevent, diagnose, treat, and eliminate malaria.

Though these new tools and approaches are key, it is equally important that we work with partners to expand access to these affordable and appropriate products so that they can have the most impact. A key element of PATH's malaria work involves understanding and improving the markets through which malaria products reach care providers and beneficiaries. We work with partners around the world to analyze markets and to address inefficiencies and barriers so that innovative, appropriately designed, high-impact products are produced and distributed at an affordable price, in sufficient volume, and through effective distribution channels. Rigorous market analysis and creative market-strengthening strategies are especially important today, in light of a robust pipeline of promising new malaria interventions under research and development.

This issue of the PATH Malaria Learning Series explores how the Market Dynamics program at PATH supports the design and implementation of data-driven, market-based interventions for malaria control and elimination. It explains how the Market Dynamics program uses analysis to identify market inefficiencies and supply chain vulnerabilities and to make recommendations to strengthen markets for malaria products. And it takes a close look at case studies covering three different malaria products—glucose-6-phosphate dehydrogenase (G6PD) diagnostics, artemisinin, and chloroquine—to show the importance of market analysis for malaria products.



What is Market Dynamics?

Markets don't achieve health equity on their own. The Market Dynamics program at PATH works to strengthen markets and advance products across the value chain.

At PATH, we define market dynamics as a discipline encompassing three interrelated areas of activity:

1. **Studying interactions among market actors*** to determine how a product is produced, procured, distributed, and delivered.
2. **Assessing market inefficiencies and identifying barriers to access and their root causes** (e.g., limited or inconsistent product availability, poor or unverified quality, inappropriate design, or lack of affordability).
3. **Improving health outcomes and equity** through creating and implementing well-designed system interventions that lead to affordable, quality-assured products and services that overcome barriers to market access.

We work with products from early-stage development to those that have been on the market for decades. We evaluate and anticipate barriers to product adoption and generate strategies to improve access and, ultimately, health equity. To understand a specific market, the Market Dynamics program utilizes a range of analytical techniques including market research, impact modeling, demand and supply forecasting, and cost-of-goods assessments. In conducting our work, we leverage other organizational strengths, from advocacy to diagnostic and drug development, to country-level systems improvements, validation, and introduction. PATH's market dynamics work is focused around the five A's of effectively functioning markets for health products: **affordability, availability, assured quality, appropriate design, and awareness** (Figure 1).¹ Equipped with a deep understanding of how markets function, PATH engages with global partners to align ideas and strategies and design road maps to achieve consistent and sustainable access to health products. In this Learning Series issue, we will explore a few of PATH's efforts to improve access to malaria products in countries around the world.

* Market actors refers to decision-makers within a given market—for example, manufacturers, purchasers, consumers, etc.

FIGURE 1. Five A's of effectively functioning markets.



Affordability

Can the people who need access to these products or services afford them?



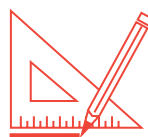
Availability

Are products or services available to consumers, either supplied by the government or private sector?



Assured quality

Are the products or services of high enough quality to work effectively as needed?



Appropriate design

Are the products or services designed for the local circumstances and needs of the patient?



Awareness

Are consumers, health providers, and health systems aware of the product or service?

Do they understand its importance? Where to acquire it and how to use it?

Expanding access to G6PD testing for appropriate and effective radical cure of *P. vivax* malaria

With an estimated 7,510,000 cases occurring globally in 2017, *Plasmodium vivax* malaria is the most frequently occurring malaria outside of sub-Saharan Africa, putting some 2.5 billion people at risk in Africa, Latin America, and South and Southeast Asia.

Unlike *Plasmodium (P). falciparum* malaria, *P. vivax* requires two different drugs to be completely cleared from the body—one for the blood stage of infection and another for the liver stage (Figure 2). However, the class of drugs currently used to treat liver-stage parasites can cause sickness or even death in individuals who have the common genetic disorder G6PD deficiency (see text box). It is therefore crucial to test people for G6PD deficiency before administering liver-stage drugs.

Any strategy to address the market challenges around *P. vivax* must coordinate stakeholders and products at the global, regional, and country level to ensure patients receive a correct diagnosis and safe treatment. Four product categories are needed for appropriate and effective radical cure:

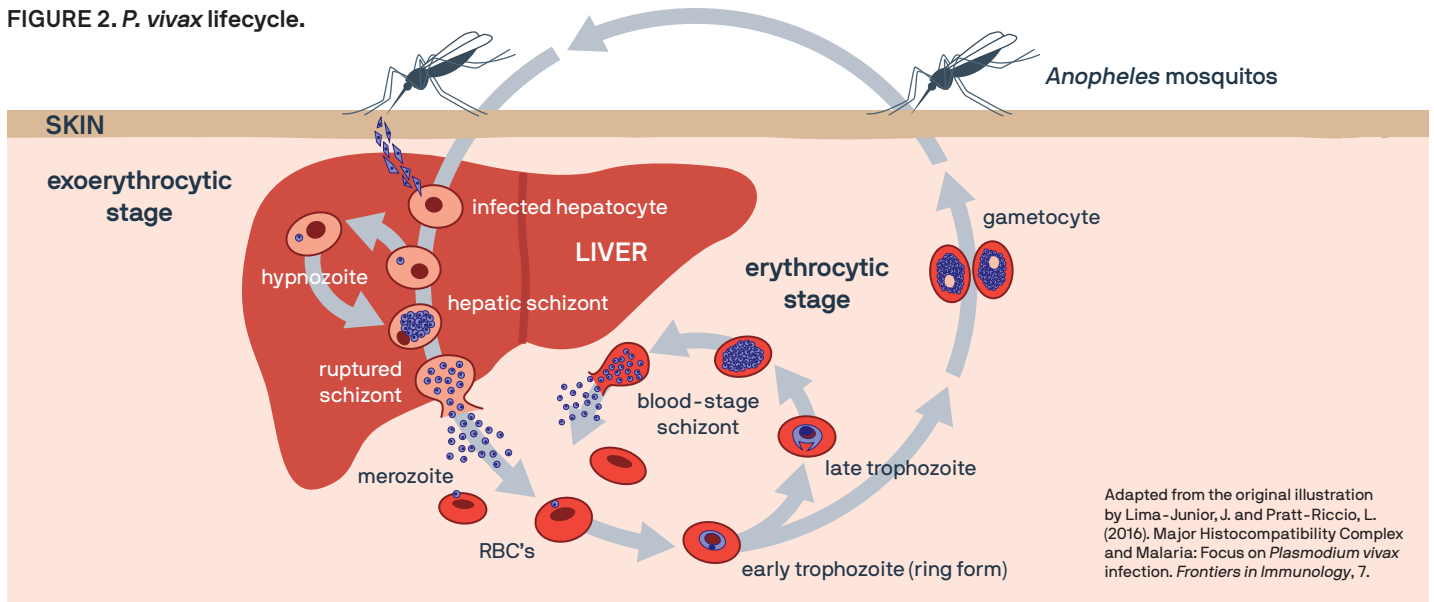
1. Point-of-care *P. vivax* malaria diagnostic tools, namely malaria rapid diagnostic tests (RDTs) or microscopy.
2. Point-of-care G6PD tests.
3. Blood-stage antimalarial drugs (chloroquine or artemisinin-based combination therapies [ACTs]).
4. Liver-stage antimalarial drugs (primaquine [PQ] or tafenoquine [TQ]).

Furthermore, a comprehensive strategy must be able to integrate new diagnostic and treatment tools that are currently under development (for example, more sensitive *P. vivax* RDTs) that will bring additional benefits to patients and accelerate the elimination of *P. vivax*.

Achieving “radical cure” for *P. vivax* malaria

At different stages in their life cycles, *P. vivax* parasites occur in the disease-causing blood stage and in a relapsing form in the liver (called hypnozoites). Two different drugs are needed to achieve complete “radical cure” of infection by eliminating parasites in both the blood and the liver. A special class of drugs called 8-aminoquinolines, which includes both primaquine and tafenoquine, are used against relapsing liver-stage parasites. Hypnozoites are especially important and challenging because they can lie dormant in the liver for extended periods (months or even years) before relapsing into the blood stream. In fact, it is estimated that most *P. vivax* transmission is driven by these relapses. Unfortunately, treatment with 8-aminoquinolines is complicated by the widespread occurrence in humans of glucose-6-phosphate dehydrogenase (G6PD) deficiency, an X-chromosome-linked genetic disorder that impairs the normal functioning of the human G6PD enzyme. Patients with G6PD deficiency who receive 8-aminoquinoline drugs are at risk of dose-dependent acute hemolytic anemia, which can result in hospitalization or death. G6PD deficiency affects approximately 400 million people worldwide,² and it is more common in areas of malaria transmission.

FIGURE 2. *P. vivax* lifecycle.

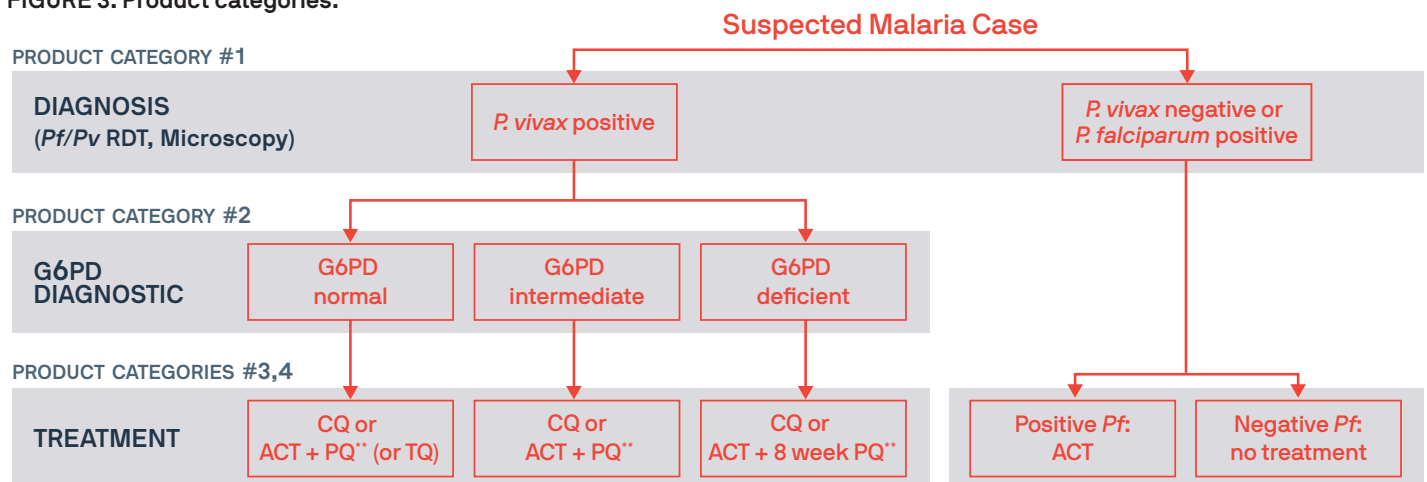


Our approach

PATH is currently working with key stakeholders to prime the market and to lay the groundwork to implement strategies that align the distribution channels and availability of the four product categories for *P. vivax* radical cure (Figure 3). PATH's ongoing work to develop and to validate G6PD diagnostics positions the organization well to expand access to G6PD diagnostics and appropriate radical cure. PATH partners with Medicines for Malaria Venture (MMV), who is leading the strategy for the global introduction of tafenoquine—a new single-dose drug that is highly effective against the relapsing liver stage of *P. vivax*. Since 2016, PATH's Market Dynamics program, in collaboration with MMV, has focused on radical cure market landscaping

and strategy creation in 10 countries. In late-2018, PATH and MMV received a five-year grant called VivAccess to continue to expand access to safe radical cure products in multiple geographies. The team is continuing work in the original focus countries and expanding into new countries based on each country's interest in adoption of safe radical cure products. PATH's and MMV's product introduction work now involves all five phases of product launch—market landscaping, strategy creation, launch planning, market entry, and scale-up. These five phases, described in detail below, have been informed by the United States Agency for International Development Center for Innovation and Impact's Ready, Set, Launch planning guide (Figure 4).³

FIGURE 3. Product categories.*



*All products should be used in accordance with labeling authorities.

**Use PQ only as recommended by WHO guidelines. Recommended only if facilities for close supervision throughout course of treatment and facilities to respond to severe PQ induced hemolytic reactions are available.

FIGURE 4. Appropriate and effective radical cure.



Phase 1: Market Landscaping

Market landscaping is the first step toward understanding the scale of the *P. vivax* problem (i.e., burden estimation and epidemiological factors), identifying the critical stakeholders in the country, and assessing how the health system functions and is financed. This includes analyzing the supply chain, procurement, and distribution channels; conducting regulatory and policy landscaping; and investigating how policy works at the point of care. During this phase, local stakeholders are engaged to understand local needs and requirements, the perceived value of new products, and market entry barriers. Phase 1 also identifies barriers and gaps to expanding access to G6PD diagnostic tests and radical cure drugs with respect to human resource capacity, training needs, supply chains, and health systems monitoring.

Phase 2: Strategy Creation

The strategy creation phase focuses on developing country-specific strategies informed by the market landscaping. This is done in close collaboration with national malaria control programs (NMCPs), ministries of health (MOHs), and other critical country stakeholders. Each strategy proposes solutions to the market entry barriers identified during market landscaping. During this phase, a road map is developed for regulatory approvals;

policy adoption; health-technology assessment criteria, processes, and timelines; funding; procurement; distribution; and delivery to health facilities and patients.

Phase 3: Launch Planning

The launch planning phase is uniquely designed for each country. Launch planning consolidates evidence for policy change, product registration, demand calculation, and subsequent integration of products into health budgets and donor requests. This phase may include pilot implementation studies of new tools for radical cure, depending on the needs of each country. During phase 3, target countries will adopt policies for introduction, and roles and responsibilities of key stakeholders will be identified.

Phase 4: Market Entry

This stage is when strategy and launch plans transition into action. Each country begins initial adoption, introduction, distribution, training, and delivery of *P. vivax* appropriate radical cure products. Any additional barriers are identified, and strategic plans are altered as necessary. New systems and materials, including for training, testing and monitoring algorithms for health workers, pharmacovigilance, data gathering, and supply chain management, are tested and closely monitored. By the end of the market entry phase, new tools for radical cure will be flowing from procurement to patient for the first time outside of a study.



PATH's Market Dynamics team, with partners Medicines for Malaria Ventures (MMV) and Global Health Strategies (GHS), visit a central warehouse in Iquitos, Peru to learn about the country's procurement and supply chain systems.

Phase 5: Scale-up

The final phase, scale-up, aims to expand country coverage within the context of local *P. vivax* epidemiology and the guidelines set out by NMCPs. Scale-up takes the lessons learned from the market entry phase, builds on the solutions identified, and continues momentum for countrywide adoption and scaled impact. The long-term goal of the scale-up phase is expansion of appropriate and effective radical cure to cover all targeted geographies in each country and to be fully integrated into regular procurement, supply chain, and test and treat activities to achieve large-scale health impact.

Results

Since 2016, PATH's Market Dynamics program team working on *P. vivax* safe radical cure has been engaging in Brazil, Cambodia, Colombia, Ethiopia, India, Lao PDR, Myanmar, Peru, Thailand, and Vietnam. Activities have included meetings and discussions with dozens of country stakeholders in the market landscaping phase to lay the groundwork and create buy-in for strategies to increase access to point-of-care G6PD diagnostic tests. Ongoing engagement with NMCPs and implementing organizations continues to build understanding of the opportunities for G6PD testing and radical cure, while also gathering the knowledge and inputs needed to inform strategies to expand access to G6PD testing.

PATH will continue to work on accelerating access to safe radical cure products. As part of the new five-year VivAccess grant, the team will support market entry and scale-up in certain countries, as well as support radical cure landscape development and strategy creation for product introduction in additional geographies. The goal with every country engagement is ultimately to work closely with country partners to increase access to the tools necessary to eliminate *P. vivax* malaria.

The *P. vivax* radical cure product introduction work is supported by PATH's Market Dynamics, Diagnostics, and country programs, all having contributed years of work along the continuum of research and development, product development, and market analysis. PATH co-leads the expanded VivAccess effort with MMV, and works closely with NMCPs, country partners, and other key policy, procurement, and regulatory stakeholders. The work is supported by the Bill & Melinda Gates Foundation and leverages work funded by the Department for International Development, such as a market assessment done in Thailand, as well as a GSK-funded project in India and current PATH malaria and neglected tropical disease projects focused on understanding the barriers and opportunities for appropriate and effective radical cure.



Health workers in Loreto, Peru, learn about the G6PD diagnostic test.

Chloroquine

Chloroquine is an essential drug in the push to eliminate *P. vivax* malaria. The Market Dynamics program at PATH is helping to ensure that chloroquine supplies continue to meet future demand.

First synthesized in 1934, chloroquine was brought into wide use after World War II, serving for decades as the gold standard treatment for most types of malaria. In the 1980s, it began to fail against *P. falciparum* in sub-Saharan Africa because of parasite resistance. It is now used primarily against *P. vivax* in Latin America, the Horn of Africa, and South and Southeast Asia, where it remains largely effective as a blood-stage *P. vivax* treatment.

Chloroquine will likely have an important role to play in *P. vivax* treatment for years to come. Chloroquine can be used in combination with primaquine (the currently recommended drug) and with the drug tafenoquine, which offers a radical cure for *P. vivax* in a single dose instead of the 14-day treatment regimen required by primaquine.* (Tafenoquine was recently approved by the US Food and Drug Administration [FDA] and the Australian Therapeutic Goods Administration [TGA].) To ensure that chloroquine supplies continue to meet future demand, the Market Dynamics program at PATH analyzed the health of the chloroquine market from the perspectives of consumers and manufacturers.

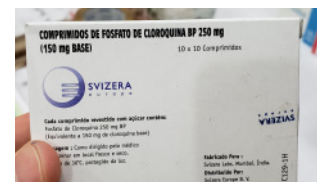
The chloroquine market today

On the surface, the chloroquine market appears to be well-functioning and resilient:

- **Chloroquine is inexpensive.** A full course of chloroquine costs only about US\$0.10 in most countries.
- **Chloroquine is abundant.** The final product version of the drug is manufactured around the world. There have been few reported instances of chloroquine shortages.
- **Chloroquine is effective.** The drug remains effective against *P. vivax* in many geographies.
- **Chloroquine is well known.** As the go-to malaria treatment for decades, consumers and providers alike are aware of chloroquine. This familiarity has sometimes made the transition to other antimalarial drugs in sub-Saharan Africa difficult, as chloroquine



Chloroquine is an inexpensive and effective drug but presents potential market challenges. The project team worked to identify any vulnerabilities in the market that could cause future supply disruptions.



continues to be used in some places where it is no longer recommended for malaria treatment of *P. falciparum* due to parasite resistance.

- **Chloroquine is produced by many quality-assured manufacturers.** There are many manufacturers who produce chloroquine in compliance with at least one Stringent Regulatory Authority such as the US FDA, the Australian TGA, and the European Medicines Agency (EMA).

Potential challenges: shrinking markets, low prices, and quality issues

The chloroquine market may be close to ideal from the consumer's perspective, but:

- The **inexpensive nature of the product, combined with a shrinking market** due to *P. falciparum* resistance and decreasing *P. vivax* case numbers, gave rise to concern that producers may no longer see a clear business case for continuing to manufacture chloroquine.
- **Quality concerns** arose in 2014 about a prominent chloroquine manufacturer, which led to **temporary shortages** of the drug in the United States and increased concern about the stability of the chloroquine market.

* Studies to evaluate tafenoquine with ACTs are planned for 2018–2019.

Our approach

Given the challenges facing the chloroquine market, and the crucial role the drug will play in continuing the fight against *P. vivax*, the PATH Market Dynamics Chloroquine Project team worked to identify any vulnerabilities in the chloroquine market that could cause future supply disruptions. The team undertook a comprehensive literature review and stakeholder interviews with NMCPs, research institutions, manufacturers, and global procurement agencies in collaboration with PATH staff members in India, Ethiopia, Vietnam, and Myanmar. Based on a synthesis of this work, the team produced a mapping analysis of the chloroquine market.

Results

Our mapping analysis confirmed that the finished product chloroquine market sector was robust. Despite the challenges facing the chloroquine market, early project findings suggested that there were a large number of quality-assured manufacturers of finished pharmaceutical product chloroquine. These producers had met the quality standards of a Stringent Regulatory Authority (SRA), such as the US FDA or EMA. All the manufacturers that the team interviewed expressed interest in continuing to manufacture chloroquine. Using ACTwatch⁴ data, the team also identified more than 175 branded, finished chloroquine products that had not met SRA standards and were of unknown quality.

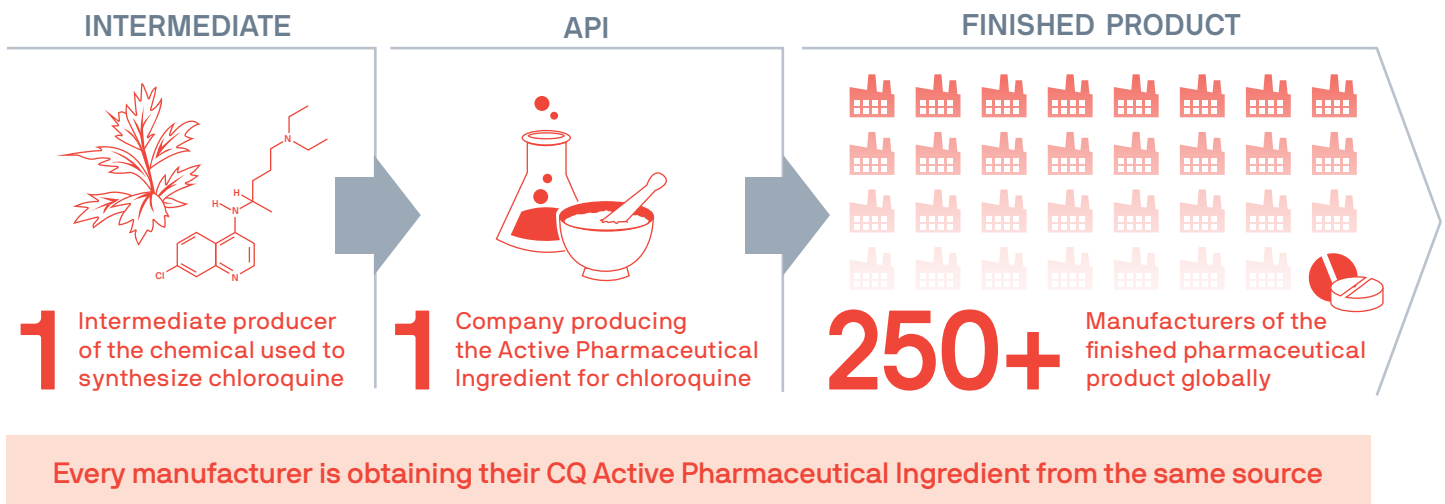
Supply chain vulnerability

After verifying that the market contained a large number of manufacturers that produce finished chloroquine, the team traced the production of chloroquine back to earlier stages of formulation. At this stage, a number of structural market vulnerabilities were revealed that could potentially lead to significant and protracted supply interruptions. For example, every finished product chloroquine manufacturer appeared to be sourcing its active pharmaceutical ingredient (API) from the same company (Figure 5). In addition, the team identified a single intermediate producer of novaldiamine, the chemical used to synthesize chloroquine API.

In effect, the chloroquine market is underpinned by single producers at both the API and intermediate stages of production, creating sole-source vulnerabilities for final pharmaceutical producers. The chloroquine market would likely face shortages if either the API or the novaldiamine manufacturer stopped production, thus underscoring the key role of these suppliers to the health of the chloroquine market.

As a consequence of this work, the PATH team recommended several actions to mitigate the risks associated with a sole-source market. These include potential interventions to ensure supply security such as supporting the quality and capacity of the existing API and intermediate manufacturers and working with them to develop strategic stockpiles. Other potential interventions include evaluating the market capacity to substitute alternative drugs for chloroquine during a shortage, such as hydroxychloroquine and ACTs. These findings were shared with an array of global funders and procurement agencies and continue to inform the Market Dynamics program's work on *P. vivax*.

FIGURE 5. Chloroquine manufacturing landscape.



Artemisinin

P. falciparum is the most common and lethal form of malaria. The vast majority of the estimated 219 million malaria cases reported worldwide in 2017 were *P. falciparum* infections, including 99.7 percent of the 200 million cases reported in the World Health Organization (WHO) African region.

Ensuring a reliable supply of safe and effective antimalarial drugs for *P. falciparum* infections is thus critical to the global effort to reduce malaria morbidity with an ultimate goal of national elimination and global eradication. Artemisinin-based combination therapies (ACTs) are currently recommended by WHO as the first-line drug for treatment of *P. falciparum* malaria.

The primary source of the key raw material used in the production of ACTs, known as artemisinin, is through agricultural production. Vegetal artemisinin is an agricultural product that is extracted from the plant *Artemisia annua* by leaf processing companies (commonly referred to as “extractors”). Artemisinin extracted from leaves is sold to API manufacturers for synthesis into the artemisinin-based APIs (i.e., artemether, artesunate, and dihydroartemisinin) used in ACTs. Prior to 2013, when a semi-synthetic form of artemisinin (SSA) was approved and launched, the world’s supply of artemisinin derived solely from vegetal sources, predominantly in China.

Historically, the vegetal artemisinin market was subject to significant volume and price volatility, leading to two major price shocks since the mid-2000s. An initial price spike occurred in 2005, following the WHO’s recommendation of ACTs for the treatment of malaria, with artemisinin prices increasing from roughly US\$250 in early 2004 to US\$752 per kilogram (kg) in 2005. A second price spike came in late 2011, when prices increased from roughly \$400 per kg to nearly \$700 per kg in a span of several months, likely as a result of a slump in production after the 2007–2008 price crash in artemisinin production and efforts by Global Fund and Unitaid to support widespread product adoption. This price volatility created boom-bust cycles in the vegetal

artemisinin market that created uncertainty for ACT manufacturers about their future access to affordable supplies of artemisinin and hurt their ability to keep ACTs affordable and available to patients globally.



Vegetal artemisinin is an agricultural product that is extracted from the plant *Artemisia annua* by leaf processing companies. Artemisinin extracted from leaves is sold to API manufacturers for synthesis into the artemisinin-based APIs.

Our approach

In 2014, PATH, in collaboration with the Clinton Health Access Initiative (CHAI), received funding from the Gates Foundation to investigate the current state of the artemisinin market and to evaluate potential interventions to ensure the stability of this market in the future. The PATH Market Dynamics program analyzed different features of the artemisinin market that could lead to price and supply instability, including information asymmetries (a situation where one party has more information than another or critical information is not being communicated to market actors effectively); market actor motivations; market speculation; levels of market concentration and fragmentation; exogenous factors (such as the weather); and the effect of interventions by international organizations (including WHO and the Global Fund). First, the project team assessed the supply of the raw product to the market, analyzing reporting from artemisinin extractors from China, where the vast majority of artemisinin is processed. Data on land under cultivation, plant yield, and extraction efficiencies were gathered to understand how the market had changed over the previous three years. In addition, the project team evaluated the relatively new semi-synthetic market and analyzed the production capacity of the facility.

Artemisinin demand was then evaluated by analyzing the market demand for quality-assured ACTs (i.e., those made by manufacturers reviewed by the WHO prequalification program) and through assumptions about the size of the non-qualified market. The analysis team then combined these two elements to create a picture of what the market had looked like over the previous three years and to project potential artemisinin demand three years into the future. Discussions with market players and malaria funders on procurement expectations and planned efforts around malaria elimination in certain countries informed the forecasting of future demand. Two extreme scenarios were tested against the demand estimates—(1) a complete cessation of vegetal production and (2) a two-thirds drop in vegetal production—to see how they would impact artemisinin supply.

The final steps were to evaluate the impact on the market of several potential interventions that could be used to help stabilize the market during periods of instability. The Market Dynamics program and CHAI looked in detail at three options:

1. **Development of a forward market** to ensure longer-term contracting and stability for market players.
2. **Creation of a strategic reserve system** to provide supply in periods of emergency.
3. **Further expansion of the production** of semi-synthetic artemisinin and shifting production from Europe to India.



Results from the artemisinin project were shared with key ACT funders, procurers, and manufacturers to ensure that artemisinin products are available when and where they are needed.

Results

Notably, the analysis showed that producers and users of artemisinin, in aggregate, held a healthy surplus of intermediate and API for the production of ACTs, a situation in stark contrast to what industry players were indicating. This trend of supply exceeding demand had persisted in recent years, and the stability and long shelf life of the intermediate and API supported company warehousing. In addition, the potential for SSA production was acting as a backstop for any future volatility in the vegetal artemisinin market. While SSA was not cost-effective to produce at low market prices, if the artemisinin price rose again dramatically, it would reach the point at which SSA was cost-effective to produce, thus catalyzing production and providing substantial market security (SSA production was estimated to be up to one-third of the 2015 global market demand). PATH and CHAI analysis indicated that even with a severe crash in vegetal artemisinin production, existing market reserves in combination with SSA production would help keep the market adequately supplied for another three to five years.

The analysis concluded that the most effective course of action was to avoid intervening in a market that appeared to be close to supply and demand equilibrium. PATH and CHAI recommended the continued use of SSA as a “virtual reserve” in the market as the most cost-effective and least disruptive intervention to ensure adequate artemisinin supply in the future. The analysis team also recommended the use of forward contracts to help provide longer-term certainty for market actors, an approach that has been adopted by the Global Fund. Our results were shared with key ACT funders and procurers as well as ACT manufacturers. Since the conclusion of the project, the results have proved to be accurate, with prices slowly declining from \$250 per kg in 2015 to \$148 per kg in May 2016 and remaining stable since then. Most importantly, the artemisinin market has continued to be well supplied, ensuring that production and supply of lifesaving ACTs has continued uninterrupted.

At PATH we believe that all people should have equitable access to critical, high-quality health products and services. Strengthening markets for malaria products is crucial to this effort.

PATH has a unique blend of technical expertise, partner relationships, and on-the-ground knowledge that allows us to identify promising new ideas, bring together collaborators, and advance innovative projects. The Market Dynamics program at PATH leverages these diverse capabilities to conduct market analysis that is rigorous, locally informed, and actionable. Our integrated approach, which leverages PATH's malaria expertise in diagnostics, advocacy, country programs, epidemiology, vaccines, and measurement and evaluation, leads to a clearer understanding of market health and to viable strategies to strengthen markets. Ultimately this work is intended to help realize PATH's vision of a world free from malaria: one in which the global community and partner countries have the tools, resources, and political will to control and eliminate malaria.



PATH is a leader in the battle to control and eliminate malaria nationally and regionally, and ultimately to eradicate it worldwide. PATH is partnering with national programs to optimize the delivery of current solutions and approaches, while developing new strategies to eliminate malaria in local and regional settings. With an unparalleled portfolio of malaria projects, PATH is developing the next generation of tools to accelerate efforts to detect, prevent, and treat malaria.

Diagnostics. In collaboration with public- and private-sector partners, PATH is pioneering the use of diagnostics for malaria elimination. We are improving access to available tests while advancing the development of new ones that support improved case management.

Vaccines. PATH's pipeline of vaccine candidates and approaches, under development with partners from across the globe, is one of the most robust in the world. It includes candidates that would prevent infection and those that attempt to block transmission of the malaria parasite from humans to mosquitoes and back again.

Drugs. PATH is working to improve malaria treatment so that no one who contracts the disease dies from it. We are ensuring a stable supply of malaria drugs and strengthening the existing supply. We are also strengthening health systems and improving the quality of malaria case management in Africa and the Mekong Region.

System and Service Innovations. To develop the science behind how to eliminate malaria in Africa, we are piloting new strategies with the goal of developing a package of approaches that are adoptable and adaptable across the region. These include strategies to stop the transmission of the malaria parasite from humans to mosquitoes and back again through community-wide treatment. We are collaborating closely with endemic countries to create malaria-free zones, the first step on the path to elimination. We are also working to strengthen vector control and counter insecticide resistance by expanding access to affordable, effective insecticides for indoor residual spraying.

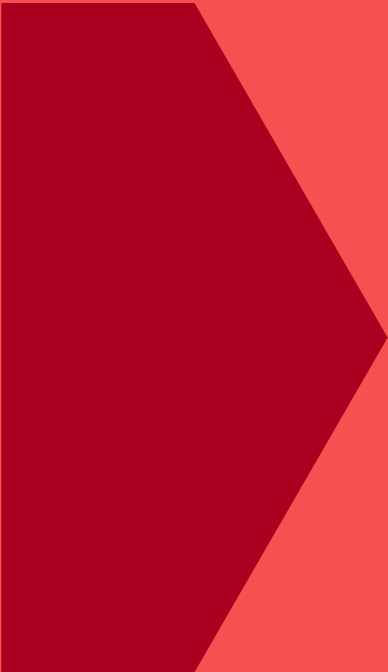
Better Data for Decision-Making and Improved Surveillance. PATH is working with partners to use data in new and better ways to track emerging transmission patterns, optimize the way resources are deployed, and eventually track down the last malaria parasite.

Endnotes

- 1 United States Agency for International Development (USAID). Healthy Markets for Global Health: A Market Shaping Primer. Washington, DC: USAID; 2018.
- 2 Nkhoma ET, Poole C, Vannappagari V et al. The global prevalence of glucose-6-phosphate dehydrogenase deficiency: a systematic review and meta-analysis. *Blood Cells Mol Dis* 2009;42(3):267–78.
- 3 United States Agency for International Development (USAID). Ready, Set, Launch: A Country-Level Launch Planning Guide for Global Health Innovations. Washington, DC: USAID. <https://www.usaid.gov/cii/ready-set-launch>
- 4 World Health Organization (WHO). World Malaria Report 2017. Geneva: WHO; 2017. <http://www.who.int/malaria/publications/world-malaria-report-2017/report/en/>

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Page 11: PATH/Kara Hedges



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