Global health security and malaria

Keeping a focus on malaria in a global health crisis

The vulnerability of the malaria drug supply chain to disruption by COVID-19 became obvious in late January 2020, when manufacturing partners first alerted the Medicines for Malaria Venture (MMV) team to looming shortages in key starting materials for malaria drug production. Our concerns intensified with the almost immediate global focus on certain antimalarials, such as chloroquine, as possible treatments for COVID-19. These developments underscored that maintaining supply of medicines to malaria patients must be a primary focus for MMV and the wider malaria community during the pandemic.

Beginning in March 2020, MMV and the World Health Organization (WHO) co-led a workstream ensuring global supply chain security for malaria commodities amid the COVID-19 pandemic. This work involved continuous coordination amongst country funders, partners and major suppliers, with a focus on safeguarding access to malaria diagnostics, long-lasting insecticide-treated nets, indoor residual spraying, and medicines. Critical work included the early identification of possible risks and bottlenecks in the upstream and downstream supply flows for all malaria commodities. MMV and partners closely monitored for unexpected shifts in product demand, and mapped the sources and supply chains of key starting materials and active pharmaceutical ingredients. This was essential and allowed for the development of risk-mitigation strategies.

As part of this work, MMV, with support from the Bill & Melinda Gates Foundation, initiated mechanisms to stabilize the supply chain and help secure chloroquine stocks for Plasmodium vivax-endemic countries, thereby mitigating the risk of treatment stockouts. Chloroquine remains widely used for treating the blood stage of P. vivax infections in many malaria-endemic countries.

In another critical area for global health security, MMV and partners closely tracked the planning and procurement cycles that were vital in ensuring limited or no disruptions in the 2020 seasonal malaria chemoprevention (SMC) campaigns across the Sahel region of Africa. Remarkably, all countries could pursue their planned SMC campaigns, estimated to have reached at least 30 million children in 2020. SMC involves the administration of the antimalarial sulfadoxine–pyrimethamine plus amodiaquine (SPAQ) to children during months of high malaria transmission (usually during the rainy season, lasting 3–4 months). SPAQ supply is essential to the success of SMC campaigns, which help keep children malaria free and thus reduce patient demands on healthcare settings overloaded with COVID-19 case management. MMV monitored the manufacturing, shipment, and delivery of SPAQ to keep access and distribution on target throughout 2020 and into 2021. SMC partners also provided guidance to countries on how to satisfy WHO-recommended personal protective equipment measures during the distribution campaigns.

Using existing expertise to help lessen the impact of COVID-19

In 2020, MMV used its expertise to support the COVID-19 pandemic response. In March, MMV sent a diverse set of drugs and compounds (including antimalarials) to test centres across Europe and the USA to investigate their potential activity against SARS-CoV-2. MMV has also provided modelling, simulation and data screening expertise to progress projects, including an antimalarial 4-aminoquinoline project that screened compounds in parallel on malaria and on in vitro SARS-CoV-2 assays.

Throughout 2020, MMV continued distribution of its Pandemic Response Box, with 125 copies distributed free of charge so far. This is one of several open-access compound libraries used by researchers globally (others

1 A laboratory process that is not conducted in a living organism.
In support of efforts to repurpose available medicines against COVID-19 and meet the needs of low-resource settings, MMV and Shin Poong Pharmaceuticals worked with investigators at Ezintsha, a research institute of the University of the Witwatersrand, South Africa, to initiate a Phase II exploratory study “ReACT” in September 2020. The trial is exploring the safety and efficacy of four different repurposed anti-infective drugs compared to standard of care in adults with mild COVID-19 infection. It will help to determine which drugs have potential benefit for COVID-19 that warrant further evaluation in larger trials. MMV also became a member of the COVID-19 Clinical Research Coalition and the ANTICOV consortium. In November 2020, the consortium launched the ANTICOV clinical trial to identify treatments early for mild and moderate cases of COVID-19, thereby avoiding spikes in hospitalizations that could overwhelm already overburdened health systems in Africa.

**Dr Meera Venkatesan and Dr Lisa Hare discuss their work and that of others in securing global health supply chains in 2020.**

Shortly after COVID-19 was declared a pandemic, global health experts predicted it could significantly disrupt malaria programmes and supply chains for malaria commodities, reversing years of hard-won progress. PMI and others have taken exceptional measures to address this situation. What are these measures and what lessons has PMI learned so far?

The pandemic has taught us that global collaboration and commitment is essential in securing malaria supplies and commodities. Critically, the global community came together early in the crisis to identify pandemic-related threats to malaria efforts. Priorities included streamlining importation requirements and estimating demands for continued production and distribution. Endemic countries also responded quickly to maintain mosquito net delivery, insecticide spraying and seasonal malaria chemoprevention.

How have countries managed malaria despite disruption from COVID-19?

To maintain progress, countries have adapted to ensure safe delivery of lifesaving malaria interventions, administering SMC through caregivers and prioritizing health worker protection. Despite these incredible efforts, there are still challenges, such as dips in availability and use of routine services, including testing, treatment, and addressing malaria in pregnancy. These disruptions can have devastating and long-lasting impacts on malaria. We need all hands on deck to protect progress.

The USA, like many countries, is facing its most devastating infectious disease pandemic in over a century. Why is it important to continue supporting the work of product development partnerships (PDPs) like MMV at the same time as dealing with a national health crisis?

COVID-19 has made it clear that a health threat anywhere is a health threat everywhere. It is important to invest in any such global threat, especially one as deadly and infectious as malaria. For example, in the Republic of Guinea during the Ebola outbreaks of 2013–2014 there were likely more malaria deaths than Ebola deaths, largely due to disrupted services. PMI is dedicated to providing support to countries, so they do not need to choose between fighting COVID-19 or malaria.

The pandemic has shown how important it is to continuously develop new tools to fight infectious disease as well as expand access to existing ones. What role does MMV play in helping partner countries and PMI to fight malaria?

PMI and MMV have synergistic roles in the fight against malaria. Today we have medicines to treat and prevent malaria, but we know that resistance to artemisinin-based combination therapies (ACTs) can spread. Therefore, we will require new antimalarial tools in future. MMV is critical for adding more tools to the box. With the PDP model, MMV has strong relationships with manufacturers and brings much-needed knowledge to the table, helping us prepare for the malaria of tomorrow.

Although COVID-19 poses a serious threat to malaria progress, what gives you hope we can eliminate this disease?

Malaria can be eliminated within our lifetimes. El Salvador is the most recent example and we are seeing similar progress elsewhere, including in the Mekong sub-Region, where PMI supports implementation of national elimination strategies. Thailand and Cambodia are aiming to eliminate malaria in the next five years, which is incredibly exciting. Despite COVID-19, countries have continued many of their lifesaving malaria prevention campaigns and are gearing up to do the same in 2021. Even though there are serious threats to malaria progress, there are also many reasons to have hope.
Antimicrobial resistance, malaria and next-generation medicines

Exposing microbes to drugs leads to selection for mutants that can survive, which is a natural process known as ‘antimicrobial resistance’. This process is a fact of life in infectious disease research and, to minimize the spread of resistance, malaria is treated with combination therapies such as ACT. Partial resistance to artemisinin derivatives has been present for two decades in South East Asia and has now been reported in several sites in Africa.\(^2\) To date, resistance to key partner drugs, such as lumefantrine and pyronaridine, has not been reported.

MMV is piloting ways of slowing the spread of artemisinin partial resistance in Africa using multiple first-line therapies (MFTs; p. 18). However, what is urgently needed are new classes of medicines that are fully active against all clinical strains of malaria and have a low propensity for malaria parasites to generate resistance. This is a key goal for MMV and, through its PDP model, MMV works with partners to fast-track innovation in antimalarial drug discovery and development.

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Dr Timothy Wells discusses MMV’s research and development strategy in 2020 in the context of global health security and antimicrobial resistance.

How did COVID-19 affect the discovery and development of new antimalarials?

©COVID-19 slowed our operations slightly, but MMV has adapted to the challenges and found new ways of working. MMV has a world-class compound logistics system, which operated continuously during 2020, transferring compounds from their manufacturing sites to testing sites. Although some of our partners had to shut down activities in the short term in response to the pandemic, we were still able to maintain delivery and produce results. At the clinical development stage, we have benefitted from teams working tirelessly to keep sites open through collaborations with our partners. We also developed new ways of ensuring clinical trial quality, despite travel restrictions.

What lessons can we learn from COVID-19 about how to do things better in the treatment of malaria?

©The rapid development of COVID-19 vaccines was only achievable through the significant upfront work that developed a solid foundation for innovation in new areas, such as messenger RNA (mRNA) vaccines and adenovirus vaccines. Funding was made available rapidly, governments took funding decisions quickly, and the pathway to approval by regulators and the WHO was streamlined extensively. For malaria, we can see how communicating a pathway to policy change is critical. We must communicate that malaria is not only a disease that kills around 400,000 people per year,3 but also has massive economic consequences in countries that can least afford such challenges.

What is your take on the emergence of partial artemisinin drug resistance in Africa?

©The challenge is to contain emerging resistance geographically, preserve the lifespan of our current medicines and prevent emergence of more resistant strains. There is a need for new classes of medicines and our most advanced are already in Phase II clinical studies. All the new medicines in our portfolio are active against existing resistance mutations in the field and we also check to see whether resistance can be generated in laboratory conditions. We prioritize those that can eliminate parasites with a low risk of resistance mutations developing. It’s important to highlight that two of our ACTs have partners that have had no resistance mutations detected (lumefantrine and pyronaridine), even after decades of clinical use in the case of lumefantrine.

What are the key priorities in malaria drug research and development?

©There are currently three priority areas: developing new medicines for uncomplicated malaria, developing new medicines for severe malaria, and finding new ways to protect people from getting malaria (prophylaxis). For uncomplicated malaria, the challenge is to have medicines that do not produce resistant parasites and also offer the chance of a simplified, shortened regimen. The single-dose cure will be difficult to achieve but would be transformative for malaria treatment. Since more than two drugs are likely to be needed, new molecules must be more and more potent. Regarding severe malaria, MMV is in partnership with the European and Developing Countries Clinical Trials Partnership and Novartis on the development of cipargamin, which is ready to be tested in patients. Prophylaxis is a key emerging area and the co-sponsored a workshop with the WHO on the ideal prophylactic medicines in December 2020. Last year, 30 million children were protected with drugs as part of SMC. In future, this may be done with an antibody therapy given once per season. Additionally, we need new therapies that are known to be safe in women at all stages of pregnancy. There is excitement regarding monoclonal antibody therapy for malaria in pregnant women as it is very specific (i.e. lower chances of off-target effects), has minimal transfer to the developing foetus and may be safe even in early stages of pregnancy.4

Dr Timothy Wells
Chief Scientific Officer, MMV

3 WHO World malaria report 2020: https://www.who.int/publications/i/item/9789240015791
MMV-supported projects

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**Target product profiles (TPPs)**

- 3-day cure, artemisinin-based combination therapies (TPP1)
- Uncomplicated malaria treatments for single-exposure radical cure (SERC) and/or resistance management (TPP1)
- Intermittent preventive treatment (TPP1)
- Severe malaria treatment/pre-referral intervention (TPP1)
- Products targeting prevention of relapse for P. vivax (TPP1)
- Prophylaxis (TPP2)

**To develop the individual compounds for combination into the TPPs, MMV has defined five target candidate profiles (TCPs):**

- Asexual blood stages (TCP 1)
- Relapse prevention (TCP 3)
- Causal prophylaxis (TCP 4)
- Transmission reduction (TCP 5, 6)

* International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use

Tackling resistance in uncomplicated malaria

In response to emerging partial artemisinin resistance, next-generation combinations are being investigated to eventually replace existing therapies. One frontrunner combination is ganaplacide–lumefantrine, currently being investigated in Phase II clinical trials.

Ganaplacide–lumefantrine (Novartis)

Ganaplacide–lumefantrine is a leading combination being assessed for its potential to treat acute, uncomplicated malaria. Ganaplacide is a fast-acting compound with a novel mechanism of action that can kill both *Plasmodium falciparum* and *P. vivax* parasites and is active against parasites resistant to current antimalarials. A longer-lasting formulation of lumefantrine – a component of Coartem® (artemether-lumefantrine) – has been developed for this new combination and clears remaining parasites. Both components also have the potential to block transmission from humans to mosquitoes. In 2017, MMV and Novartis initiated a Phase Ib clinical trial across Africa and Asia. Results from Part A of the study in 349 adults and adolescents aged ≥12 years treated for 1–3 days showed rapid killing of parasites and a low treatment failure rate. Part B started in October 2020 and aims to include 175 patients between the ages of 2 and 12 years.

Other ongoing studies include a paediatric ‘KALUMI’ study investigating ganaplacide–lumefantrine in children aged between six months and 12 years, which began in the first quarter of 2021. It aims to include at least 224 patients from sites in Mali, Burkina Faso, Gabon and the Republic of Guinea. Depending on current studies, the Phase III study investigating ganaplacide–lumefantrine could be initiated in 2022 and a stringent regulatory authority filing could be made in late 2024.

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**Dr Rella Manego discusses the burden of malaria in Gabon and the Phase IIb study investigating ganaplacide–lumefantrine in children as young as six months old with uncomplicated malaria.**

**What is the burden of malaria in Gabon and what impact does the disease have on individuals, communities, and the country as a whole?**

Gabon has a high burden of malaria, with 50% of the population infected at any one time. Malaria results in a high fever and a high mortality rate in vulnerable populations, including children under five years of age. This high prevalence has an impact on individuals and communities as malaria keeps people out of work, leading to an economic impact on the country as a whole.

**The ganaplacide–lumefantrine Phase IIb study is being conducted in four African countries. What is exciting about this combination and study?**

The Phase IIb study is being conducted in Gabon, Mali, Burkina Faso and the Republic of Guinea. Ganaplacide–lumefantrine has shown fast-acting activity against multiple stages of the malaria parasite life cycle and effectively reduces malaria transmission. It is exciting because this study is investigating a new, once-daily formulation of lumefantrine in combination with ganaplacide in children as young as six months old with uncomplicated malaria.

**Why is the trial needed in children between the ages of 6 to 12 months?**

Children are at highest risk of dying from malaria, however, there can be problems with current formulations of antimalarials when administered to children. To treat this high-risk population, we need new child-friendly formulations.

**Why is it important to have another treatment for uncomplicated malaria?**

It is important to have new drugs to treat uncomplicated malaria in the event of emerging parasite drug resistance. A single-exposure radical cure would be the ideal antimalarial in this setting. It is also important that any new treatment for uncomplicated malaria is affordable.

**What benefits do you see from the study being managed through a partnership between a pharmaceutical company (Novartis) and a not-for-profit organization (MMV)?**

There are mutual benefits having the study managed through this partnership. At every stage, experience can be shared between partners, particularly regarding manufacture and distribution, which benefits study management as well as the malaria patients themselves.

**Why and how do you think this new antimalarial combination will contribute to the global malaria elimination agenda?**

As a new combination, it will help tackle emerging resistance and, with its short regimen, it will improve compliance. If successful, this new antimalarial combination will have an enormous effect on malaria elimination.
Maintaining a healthy pipeline of candidate antimalarial drugs

Antimalarial drug failure is an ongoing risk throughout the drug development pipeline, and resistance can lead to drug failure in the clinical setting. To protect the pipeline against these risks, MMV aims to maintain a strong and continuous pipeline of candidate drugs. In 2020, several key molecules were moved forward in clinical development.

- Ferroquine
  Ferroquine is a member of the 4-aminoquinoline family. Following the termination of the artefenomel-ferroquine combination due to poor tolerability, the rights of ferroquine were transferred to MMV from Sanofi in October 2020. This allows it to be further investigated in new Phase II combination studies.

- M5717 (Merck)
  M5717, originally discovered as part of an MMV-led collaboration with the Dundee Drug Discovery Unit and now in development at Merck, shows activity against all stages of the parasite life cycle (except for the dormant liver stage of P. vivax malaria) and targets the protein-making machinery of the malaria parasite. In a Phase I study in 2018, M5717 was well tolerated and an 800 mg dose completely cleared blood-stage infection in a volunteer infection study (VIS). Embryofetal and fertility studies in laboratory models of malaria were completed in 2020 showing a clean profile. A VIS evaluating the prophylactic activity of M5717 in humans is ongoing. Merck is working with MMV to prioritize partners for a potential combination Phase II study for treatment of malaria.

- ZY19489 (Zydus Cadila)
  ZY19489, in development with Zydus Cadila, has shown a good safety profile in both non-clinical toxicology studies and Phase I studies in humans, a low susceptibility to resistance, and a profile that suggests it may eventually be suitable for use in pregnancy. A blood-stage VIS and an embryofetal development study were completed in 2020, with a formulation development study still underway. ZY19489 in a combination therapy has the potential to become a single-exposure, blood-stage treatment for acute, uncomplicated P. falciparum and P. vivax malaria.

- MMV533
  MMV533 was recommended by MMV’s ESAC as a preclinical development candidate due to its rapid parasite killing and a long half-life. A Phase Ia safety and tolerability study of MMV533 was initiated in the third quarter of 2020.

2020 saw the termination of two development compounds. MMV048, originally discovered and developed by an international team led by Prof. Kelly Chibale at the University of Cape Town, South Africa, was the first antimalarial candidate compound to enter a Phase I study in Africa. Extensive non-clinical toxicity studies determined that MMV048 is a potent teratogen, and the programme has been discontinued. The lessons learned on the safety of this molecule have been passed on to other groups focusing on the same molecular target with the hope that a second-generation compound can be designed to overcome these weaknesses. Another compound that was discontinued called P218 is a P. falciparum dihydrofolate reductase inhibitor that was developed in collaboration with Biotec, Thailand. Phase I studies showed that it had a short half-life and, therefore, would need to be given daily to provide prophylaxis. In collaboration with Janssen, long-acting formulations have been investigated but none have been able to reach the current target product profile.
Characterizing resistance

Given the urgent need to develop new antimalarial treatments, it is important to have a defined and consistent way of characterizing the risk of resistance emergence to a specific compound, and ranking them compared to one another. We can then make fully informed decisions regarding the choice of compounds to take forward.

Can you describe your work and how it will help MMV identify drugs that combat resistance?

My work focuses on the identification of new drugs with blood-stage efficacy and manageable or no resistance. I oversee various parasitology and pharmacology platforms supporting the discovery of new antimalarial compounds.

Based on clinical observations, various partner testing platforms and expert input, we have developed a new strategy that allows us to detect and characterize the risk of resistance at each step of the pipeline. We use known modes of action and mechanisms of resistance, genetic testing, detailed in vitro analysis and in vivo experiments. This allows us to identify and deprioritize early- and late-lead series exhibiting a very high risk of resistance, and have a comprehensive assessment of the resistance risk at the level of candidate selection.

What drew you to work on malaria drug resistance, and why is this work important?

Drug resistance is fascinating because it demonstrates the idea that “evolution always wins”. A number of years ago, partial resistance to artemisinin derivatives emerged in South East Asia, with worrying signs also recently detected in Africa. Fortunately, when artemisinin is used in combination with other drugs, such as lumefantrine or pyronaridine, efficacy is maintained. Having a well-characterised picture of the risk of resistance of an antimalarial compound early in its development helps us make better-informed decisions across the whole MMV pipeline.

How does this work fit in with MMV’s research and development strategy and the resistance work being conducted by David Fidock and his team who were awarded MMV Project of the Year 2020 (pp. 40-41)?

With its unparalleled expertise in molecular parasitology, the Fidock Lab has profiled over 180 compounds and discovered 18 new modes of action and mechanisms of resistance. David and his team have been a central pillar in our resistance work. In addition to being key contributors to the in vitro experiments that support our strategy, their research has interrogated drug resistance in the malaria parasite, increasing our understanding of malaria parasite biology. This understanding has informed our new resistance strategy that investigates resistance risk throughout the drug development process.

What has been the impact of your project on MMV’s portfolio?

Once the strategy has been validated using clinical data on the advanced compounds in our profile, the impact is likely to be an increase in the down prioritization of projects presenting an unacceptable resistance risk, freeing up resources to focus on more promising projects. We are expected to deliver preclinical candidates with a comprehensive resistance risk assessment, ultimately leading to fully informed decisions regarding compound prioritization and partner drug selection.
Multiple first-line treatment options for uncomplicated malaria

In 2001, the WHO recommended ACTs as first-line therapy for uncomplicated malaria, a decision largely driven by the devastating emergence of resistance to existing therapies (chloroquine and sulfadoxine-pyrimethamine) in Asia, Africa and Latin America. In addition to increased efficacy, a key benefit of using drugs with different mechanisms of action in combination, such as in ACTs, is delaying the emergence of resistance. Currently, the WHO recommends six ACTs for the treatment of uncomplicated *Plasmodium falciparum* malaria, creating a pool of antimalarial medicines for uncomplicated malaria which healthcare workers in the public and private sectors can choose from. This is referred to as a multiple first-line treatment (MFT) policy and is a pre-emptive approach to drug-resistance management. By providing MFT options, it is possible to further delay the emergence and spread of resistance by challenging malaria parasites with many different types of drugs (rather than with a single combination). An MFT approach quickly replaces discontinued options and limits the risk of single medicines becoming out of stock.

**Pyramax®**, **Eurartesim®** and **Coartem®**

*Pyramax* (pyronaridine–artesunate) was brought forward by MMV and Shin Poong Pharmaceuticals to treat acute, uncomplicated *P. falciparum* and *P. vivax* malaria. It is available as tablets and granules for adults, children and infants, with both formulations included in the WHO’s prequalified medicines and the Essential Medicines Lists for adults and children. Eight sub-Saharan African countries had adopted Pyramax in their national treatment guidelines by the end of 2020. An additional three countries are expected to do the same by the end of 2021.

At the national level, the WHO recommendation of ACTs has led to malaria-endemic countries positioning ACTs as first-line therapy options, however, often only one ACT is routinely used. Over the last 15 years, the work of MMV and others in developing multiple ACTs, and supporting innovation and optimization of how these treatments are used has led to some countries progressing effective MFT policies and programmes. Countries adopting this strategy include Angola, Brazil, Burkina Faso, Nigeria and Myanmar.

MMV is supporting two pilot studies investigating the operational use of an MFT approach: a pilot evaluation in Burkina Faso that included dihydroartemisinin–piperaquine, pyronaridine–artesunate and artemether–lumefantrine has recently been completed, with analysis still ongoing, and an additional evaluation in Kenya was initiated in June 2020. MMV continues to support the research and development of novel antimalarials for uncomplicated malaria, including the following ACTs:

- **Pyramax®**, **Eurartesim®** and **Coartem®**

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**Eurartesim** (dihydroartemisinin–piperaquine) was brought forward by MMV and Alfasigma S.p.A to treat acute, uncomplicated *P. falciparum* malaria in adults, children and infants > 5 kg. It received WHO prequalification in 2015 and was added to the WHO Essential Medicines List in 2017. **Eurartesim** is included in the national treatment guidelines of five African countries.

**Coartem** (artemether–lumefantrine) is used to treat uncomplicated *P. falciparum* malaria. Its tablet formulation developed by Novartis and dispersible tablet (Coartem Dispersible) formulation, brought forward by MMV and Novartis, are suitable for adults and children between 5 and 24 kg. In 2008, **Coartem Dispersible** became the first child-friendly ACT to be approved by a stringent regulatory authority. Currently, an artemether–lumefantrine formulation suitable for infants < 5 kg is being developed in order to meet the need of an approved ACT for this patient population. **Coartem Dispersible** is approved in 50 countries.
Dr Mohamadou Siribié discusses the pilot MFT evaluation in Burkina Faso.

What are the inherent challenges and advantages of an MFT approach for the treatment of uncomplicated malaria?

“MFT reduces pressure on the use of a single ACT and increases the therapeutic life of multiple ACTs, which are both critical in the fight against malaria. MFTs also improve access to a range of ACTs in endemic settings. In terms of challenges, acquisition of sufficient ACTs for use in MFT can be difficult in a real-world setting. Managing ACT distribution and prevention of stockouts are other required considerations. The training of health workers and setting up supportive monitoring at a health facility level can also be challenging.”

Could you briefly describe the formative phase of the MFT pilot evaluation in Burkina Faso?

“The formative phase of the pilot evaluation included the generation of baseline information and development of tools for implementation. Baseline information included perception and expectation of MFT strategy by health system stakeholders and community members. In addition, it aimed to document any perceived/existing obstacles to implementation, treatment-seeking behaviour for febrile episodes/malaria, and morbidity and mortality rates in the pilot evaluation area. ACTs were delivered according to patient category (e.g. pregnant women) and age (adults/children).”

Who were the partners you worked with and how was it conducted?

“In Burkina Faso, a consortium was set up to conduct this pilot evaluation. The leading research institute in the consortium is the Groupe de Recherche Action en Santé (GRAS), a second research institute that evaluates the effects of the programme through its health and demographic surveillance system that covers part of the pilot evaluation area. An additional partner is the Ministry of Health of Burkina Faso through its technical department, the National Malaria Control Programme. This serves as the main link between the researchers, the central drug store in the country and the national health system. This work is possible with the financial and technical support (i.e. protocol development and monitoring of activities) of MMV.”

How easy/difficult was it for the health workers to accept the MFT protocol?

“It was relatively easy in the evaluation area. Malaria is one of the top 10 diseases in Burkina Faso, so health workers are familiar with the management of uncomplicated malaria. Health workers included in the evaluation were retrained on malaria diagnosis, prescription of ACTs (especially the newer combinations), pharmacovigilance and management of ACTs prior to deployment. The health workers benefitted from supportive monitoring visits from the health district management and research teams. The main difficulty was the turnover of health workers involved in implementation, which could have affected their compliance with the evaluation protocol. Fortunately, this has been mitigated by hands-on training for the new staff.”

What has the pilot evaluation revealed so far?

“We have just completed the evaluation phase of the pilot. According to preliminary data, approximately 81,000 malaria episodes in children under five years old benefitted from pyronaridine–artesunate treatments, 4,700 malaria episodes in pregnant women benefitted from artemether–lumefantrine, and 90,000 malaria episodes in individuals five years and older benefitted from dihydroartemisinin–piperaquine administration. So far, no serious adverse drug reactions have been reported.”

From your perspective, how could the use of MFTs benefit Burkina Faso’s malaria control programme? How could it support the country’s efforts to eliminate malaria?

“Currently, the Burkina Faso malaria treatment guidelines recommend three ACTs — amodiaquine–artesunate, artemether–lumefantrine and dihydroartemisinin–piperaquine. Only artemether–lumefantrine is available at the health facility level for treating uncomplicated malaria. Our pilot evaluation offers additional ACTs at this level and is the first opportunity for distributing two additional ACTs (dihydroartemisinin–piperaquine and pyronaridine–artesunate). National guideline revision is underway, and our evaluation has been instrumental in promoting future adoption of pyronaridine–artesunate. Pilot evaluation data will be made available to policy makers and we hope this data will be used to scale up MFT if results are positive.”

What has it been like to work with MMV on this pilot evaluation?

“This has been my first opportunity to work with MMV and I greatly appreciate our collaboration. We look forward to reporting successful results and continuing our work with MMV on future research in Burkina Faso.”