

## **Title**

### **Supporting the Development and Implementation of Improved Diagnostic Solutions for Malaria Control and Elimination**

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#### ***Biography of Presenting Author***

Iveth J. González is medical doctor from Colombia with a PhD degree in basic sciences from the University of Lausanne in Switzerland. She has worked on basic and clinical research applied to tropical diseases, more specifically malaria, leishmaniasis and Chagas disease. She is currently the head of the Malaria & Acute Febrile Syndrome programme at FIND in Geneva, where she has contributed to the development and implementation of diagnostics solutions for malaria and neglected tropical diseases.

#### **Abstract:**

Malaria is one of the four most burdensome infectious diseases globally and the fifth highest cause of child mortality. The 2014 World Malaria Report estimates that in 2013, there were 198 million cases and 584,000 deaths due to malaria. However, remarkable progress has been made in malaria control during the last decade. For the second time in history, the world is actively fighting toward malaria elimination. Sustaining global gains and accelerating actions toward malaria elimination requires better access to appropriate individual diagnosis and effective surveillance and response tools. FIND is committed to increasing access, even in the remotest areas, to high-quality malaria diagnostic tools that have the confidence of health workers and patients. As progress towards elimination is made, country by country, our ability to accurately identify the remaining malaria infections with effective diagnostic tests will be critical for success. Across all FIND's activities, collaborating with partners is essential. We work with academia, industry, national malaria control programmes, other international organizations, implementation agencies and global procurement agencies to increase access to effective malaria diagnosis.

#### **Keywords:**

Malaria, diagnostics, control, elimination

#### **Extended Abstract**

Malaria is one of the four most burdensome infectious diseases globally and the fifth highest cause of child mortality. In 2013, there were an estimated 198 million cases and 584,000 deaths due to malaria. Despite these relatively large figures, remarkable progress has been made in malaria control during the last decade. According to the 2014 World Malaria Report, the number of malaria infections has dropped 26% since the year 2000, 55 out of 106 endemic countries are on track to meet the global target of reducing malaria incidence by 75% of 2000 levels by 2015, and 19 countries are already in pre-elimination or elimination phases (World Health Organization 2014). Sustaining these gains and accelerating actions toward malaria elimination requires improved access to appropriate individual diagnosis as well as effective surveillance tools.

FIND is a non-for-profit organization dedicated to the development and implementation of diagnostic solutions for diseases related to poverty. Malaria has been one of FIND's three core disease programmes since 2007. The cornerstone of FIND's work on malaria has been the development and implementation of a global programme for the evaluation of rapid diagnostic tests (RDTs). In collaboration with the WHO and several partners in endemic and non-endemic countries, FIND has developed and coordinated a global malaria RDT evaluation programme to guide public sector procurement of malaria RDTs and to ensure the quality and safety of product batches before they are distributed in the field. Since the start of the programme in 2007, there has been a substantial increase in the quality of tests being procured (FIND 2015). The availability of high quality RDTs has significantly improved and in 2013, for the first time ever, the total number of RDTs procured exceeded the number of artemisinin-based combination therapies distributed in the WHO African Region (World Health Organization 2014). FIND and partners are currently establishing mechanisms to ensure the long-term sustainability of the programme.

While access to appropriate diagnosis and treatment is increasing, it is estimated that only 62% of patients with suspected malaria received a diagnostic test in 2013 (World Health Organization 2014). An important proportion of febrile patients in malaria-endemic countries seek care in the private sector where RDTs are unavailable or of substandard quality. In consequence, a large proportion of these febrile cases are empirically treated as malaria, leading to the overuse of antimalarial drugs and mistreatment of other potentially life-threatening febrile illnesses (Ruizendaal et al. 2014). FIND is supporting the work of implementing organizations to create a market for good quality RDTs in the private health sector of endemic countries. While concerted work with health ministries and regulatory bodies is required to harmonize disease policy and procurement, training tools and guidance on proper RDT use are also needed. Integration with national quality assurance systems and supervision of operator performance are also needed to ensure access of patients to good quality RDTs in the private sector.

Malaria elimination can only be achieved if all malaria infections are detected and promptly treated to stop transmission. It has been demonstrated that asymptomatic infections contribute to the perennial transmission of malaria in endemic settings (Lin Ouédraogo et al. 2015). While microscopy and RDTs are appropriate for case management, they miss more than 50% of asymptomatic infections when compared to NAATs (Lindblade et al. 2013). FIND led the delivery of the loop-mediated DNA isothermal amplification (LAMP) kit for malaria, a field-stable, highly sensitive NAAT that allows PCR-level malaria diagnosis. This kit was brought to the market in 2012 and has been evaluated in several low-endemic countries to detect asymptomatic infections and guide treatment to support elimination (Morris et al. 2015; Vallejo et al. 2015). A second-generation test with high throughput for population screening has completed development and is being tested in the field in 2015. The requirement of electricity and basic infrastructure confine the use of LAMP to health facilities where reference testing for surveillance could be done. A highly sensitive test that would allow for the rapid detection and on-site treatment of all infections in remote settings, including asymptomatic cases, is required. FIND is also supporting the development of an improved RDT that can detect sub-microscopic infections, thereby identifying more infections and guiding rapid treatment to stop transmission.

While efforts continue to eliminate the most deadly form of malaria, caused by *Plasmodium falciparum*, detecting and treating malaria due to other *Plasmodium* species must also improve. Around 2.85 billion people around the world are at risk of infection with *P. vivax* parasites, 57% of them living in areas of unstable transmission (World Health Organization 2014). In countries where both *P. falciparum* and *P. vivax* parasites are transmitted, the incidence of *P. falciparum* is decreasing faster than that of *P. vivax*, in large part due to the biological characteristics of these parasites. Infections by *P. vivax* parasites are characterized by inducing symptoms at lower parasite densities in blood than those by *P. falciparum*; by producing gametocytes, the form that is transmitted to mosquitoes, earlier in the infection; and by generating hypnozoites, a dormant form of the parasites that can persist, undetectable, in the liver for years or even decades. There are currently no diagnostic tools available to detect reservoirs of hypnozoites. All these characteristics, plus the fact that radical cure of *P. vivax* infections requires the use of drugs that could be toxic to people deficient in glucose-6-phosphate dehydrogenase (von Seidlein et al. 2013), highlight the urgent need for accurate, more sensitive and more stable diagnostic test for this form of malaria. FIND and partners are working in the development of better tools to detect and treat reservoirs of *P. vivax* parasites.

From 2015 to 2020, FIND will continue to support the Global Malaria Action Plan and WHO targets to bring global and national mortality near zero for preventable deaths, and support countries currently in the pre-elimination stage to achieve elimination. FIND also supports the long-term global goal of malaria eradication by reducing the global incidence of malaria to zero. For the second time in history, the world is actively fighting for malaria elimination. As progress is made toward this potentially historic achievement, our ability to accurately identify the remaining malaria infections with new and effective diagnostic tools is clearly a prerequisite for success. As malaria dwindles, new tools will help to keep antimalarial interventions focused and effective, and will enable malaria patients to be correctly treated in this rapidly changing context.

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