

Perspective on Malaria Elimination in India

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Perspective

India observed a significant reduction in malaria cases in the previous year, reaffirming our trust and efficiency of the existing tools to achieve malaria elimination. On 25 April, 2019, countries round the world marked World Malaria Day under the theme "Zero malaria starts with me". This provides a chance to rejoice the success and re-evaluate ongoing challenges within the fight against this preventable and treatable parasitic disease. We highlight the potential gaps within the malaria elimination program, and underscore potential solutions and methods to implement, improve and intensify the success of the national goal of malaria elimination by 2030.

India features a long history of success and struggles with malaria control. The unsuccessful endeavor to eliminate malaria, and increasing morbidity and mortality bring back the elimination agenda within the health care priorities. In 1976, there was a huge resurgence of malaria cases and Plasmodium falciparum resistance to chloroquine and vector resistance to insecticides were reported. As a consequence, the modified plan of operations was launched in 1977 with a three-pronged strategy: early diagnosis with prompt treatment, vector control, and knowledge Education Communication (IEC)/ Behavior Change Communication (BCC), leading to the decline of malaria incidence again in 1984. Subsequently, Enhanced Malaria Control Project in 1997 and Intensified Malaria Control Project in 2005 were launched to combat malaria in high transmission areas of the country. New tools for malaria prevention and control were introduced by National Vector Borne Disease Control Program (NVBDCP) i.e., monovalent rapid diagnostic tests (RDT) for *P. falciparum* detection in 2005; Artemisinin-based combination therapy (ACT) in 2006; Long-lasting insecticide-treated nets (LLINs) in 2009; antigen detecting bivalent RDTs for detection of both *P. falciparum* and *P. vivax* in 2013; and newer insecticides and larvicides in 2014-15. However, these strategies did not repose on its expected level of achievements. India moved towards global commitment for malaria elimination and endorsed an idea to eliminate malaria throughout the region by 2030. World health organization (WHO) has developed the worldwide technical strategy for malaria under the National framework for malaria elimination in India 2016-2030 to eliminate malaria (zero indigenous cases) throughout the entire country by 2030, and maintain malaria-free status and stop its re-introduction. Therefore, we'd like to place all our efforts to realize the specified success this point.

Disease Burden and Surveillance

In 2018, an estimated 228 million cases of malaria occurred worldwide, compared to 251 million cases in 2010. In India, a population of 126 million was in danger of malaria with an estimate of 6 million cases in 2018, while 0.43 million confirmed cases of malaria were reported by NVBDCP in 2018;

although, discrepancies between various sources are noted. In India, malaria is very endemic in rural and tribal areas of Madhya Pradesh, Maharashtra, Odessa, Rajasthan, Gujarat, Jharkhand, Chhattisgarh, Andhra Pradesh, West Bengal, and Karnataka. Further, districts with 30% or more tribal population comprising about 8% of the country's population contributed to 46% of total malaria cases, 70% *P. falciparum* cases and 47% malarial deaths in the country. However, India has shown a 71% reduction in 2019 as compared to 2015 and this reduction was achieved by strengthening the surveillance measures, improving diagnosis and treatment, and intensive vector control measures using existing tools. For example, Odessa contributed 37.4% of total malaria cases in 2015 which reduced to 12% in 2019 using the Durgama Anchalare Malaria Nirakaran (DAMaN) initiative and comprehensive case management of malaria. To sustain the achieved reduction and moving forward to the elimination, we've to strengthen all the strategies using existing tools and by developing new tools.

Challenges and Solutions: Strengthening Malaria Diagnosis

Accurate diagnosis is the key to success in the elimination goal. Among the five Plasmodium species, *P. falciparum* and *P. vivax* cause the bulk of cases and other species are rare, but the diagnosis is complicated by the numerous distribution of both mono-infection and mixed infections. Microscopy has always been the gold standard method but it requires highly skilled microscopist with genuine knowledge of various stages of Plasmodium species with capability to read low-density parasitemia - fulfilling such a requirement in rural India may be a daunting task, as a consequence, quite 1 / 4 of malaria cases are missed by microscopy. RDTs are used where microscopy isn't feasible. *P. falciparum* histidine-rich protein 2 (PfHRP2) antigen targeting *P. falciparum* is used in more than 90% of the malaria RDTs. However, deletions of the Pfhrp2 gene within the parasite, fluctuation within the expression level of Plasmodium Lactic Dehydrogenase (pLDH), and prozone phenomena are the main problems resulting in inaccurate diagnosis of plasmodium species. Therefore, other potential biomarkers like heme-detoxification protein, apical merozoites surface protein, Glutamate dehydrogenase, and hypnozoites-based serological marker should be validated to strengthen the RDT tool. Molecular methods like Polymerase chain reaction (PCR) are feasible for the diagnosis of malaria (particularly low-density infection). However, these methods like conventional PCR, nested PCR, qPCR, multiplex PCR, and Loop-mediated isothermal amplification (LAMP) are less frequently used techniques thanks to longer time required, need for advanced equipment, expensive reagents and experienced personnel, and difficulty in organizing in most field conditions. A hemozoin-based magneto-optical detection device (Gazelle) may prove an alternate to RDT for accurate diagnosis within the field. These new markers/tools can make an impression on elimination efforts by addressing the matter of missed diagnosis.

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