

NEWS & VIEWS

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2020**

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to watch this month**

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MERA-INDIA Newsletter 'News & Views' January 2021

World Malaria Report, 2020

WORLD MALARIA REPORT 2020



YEARS OF GLOBAL PROGRESS & CHALLENGES



World Health
Organization

Figure 1: [Front page of World Malaria Report, 2020](#): In this year's World malaria report, WHO reflects the key milestones that have shaped the global response to the disease

over the last 2 decades – a period of unprecedented success in malaria control that saw 1.5 billion cases averted and 7.6 million lives have been saved. According to the report, global malaria mortality fell by 60% over the period 2000 to 2019, with impressive reductions achieved by African Region. Countries in South-East Asia have also made particularly strong progress, with reductions in cases and deaths of 73% and 74%, respectively.

India contributed to the largest drop in cases region-wide – from approximately 20 million to about 6 million.

Malaria Diagnostic Strategies



Figure 2: [Diagnostic tools to study malaria in India \(a-d\)](#). Direct methods of parasite detection include light microscopy of thick and thin stained blood films on a glass slide, to visualize malaria parasites, by using Giemsa stain (a). Another commonly used direct method of detection is RDTs (rapid diagnostic tests) to detect parasite antigens such as Histidine rich protein2 or lactate dehydrogenase (LDH) of the parasites (b, c). Furthermore, among the indirect methods of identification of malaria infection, molecular methods such as the Polymerase Chain Reaction (PCR) assays are routinely used that have higher sensitivity over direct methods (d).

Challenges of Malaria Elimination: Can GIS help?

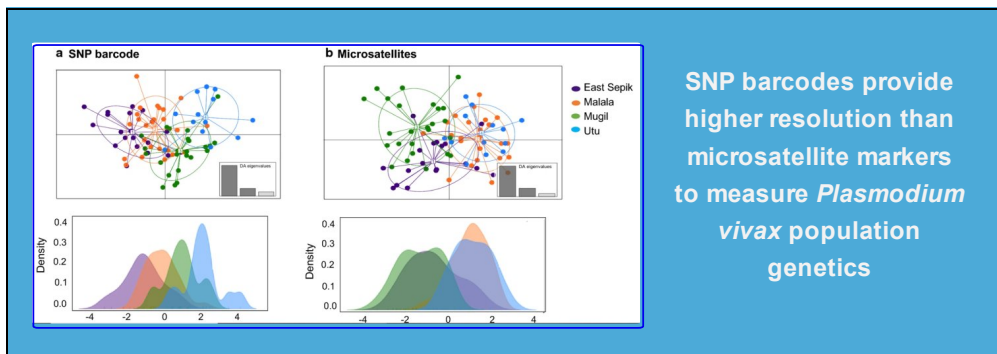
Among the vector borne diseases, malaria has always occupied the center stage, historically because it was the single largest killer in tropical countries and was a significant contributor to the burden of diseases in the first half of the 20th Century. In the second half of the century, it held out the biggest promise of elimination with the use of effective anti-malarial drugs and mosquito eliminating pesticides. However, malaria elimination remained eluded in spite of significant gains. The geographical dimensions also kept changing as we faced newer problems like urban malaria, construction related malaria, peri-urban malaria, etc. The malaria elimination strategies kept evolving and integrated approaches were tried but the elimination still remained a distant dream; it's so near, yet so far. There are certain habitation pockets where malaria refuses to be eliminated and to some extent we are clueless about how to tackle this problem. On the other hand, there are some pockets which remain hidden or are difficult to reach and in spite of best efforts, malaria continues to persist even at a low endemicity. In a large and geographically diverse country like India, it is a big challenge.

In such a scenario, Geographic Information System (GIS) can be seen as a handy tool. GIS, with the zooming capability, can help in mapping all the possible hotspots of malaria in the country and depicting the distribution of risk factors of malaria on a digital map. The interactive user interface and versatility of GIS give us a pictorial overview of all the factors that contribute to sustained malaria endemic, like the vector breeding habitats, human habitation, movement and migration, and malaria related risk behavior parameters of the susceptible population. Integration of diseases data and weather data like rain fall, humidity, temperature etc. can be helpful to know the incidences and prevalence of the disease with the help of GIS tools. This information can play a vital role in the disease elimination strategies.

Further, the information can be plotted on digital maps. Irrespective of size of the specified area, small or large, (even an entire state), both can be seen on the screen and distribution of all variables can be visualized. This can be helpful in understanding of complex data and can help in the development and implementation of area specific interventions. GIS tools have the capability of not only depicting the maps but also to carry out spatial and temporal analysis of disease related data. Such analysis can develop epidemiological forecasting models and can also assess operational feasibility of intervention tools. Using GIS applications, digital dashboards can also be developed that can strengthen monitoring of the disease as well as disease elimination interventions in real time, course correction and need based alteration in interventions. The ongoing pandemic of COVID-19 has demonstrated the usefulness of dashboards, mapping and spatial and temporal analysis in understanding the dynamics of disease transmission, up to date knowledge about spread of the disease and planning containment zones. The role of GIS is also being explored in vaccine distribution. The success of GIS in pandemic management will expand the scope for its wider application in elimination of malaria and other vector borne diseases.

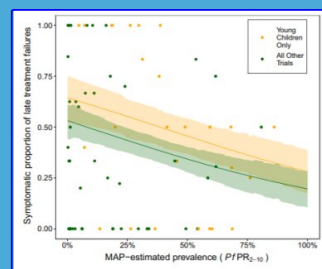
(By: Dr Arun Sharma, Director-Professor, Community Medicine, University College of Medical Sciences, Delhi).

Scientific Contributions by dedicated scientists/researchers in the field of Malaria Research

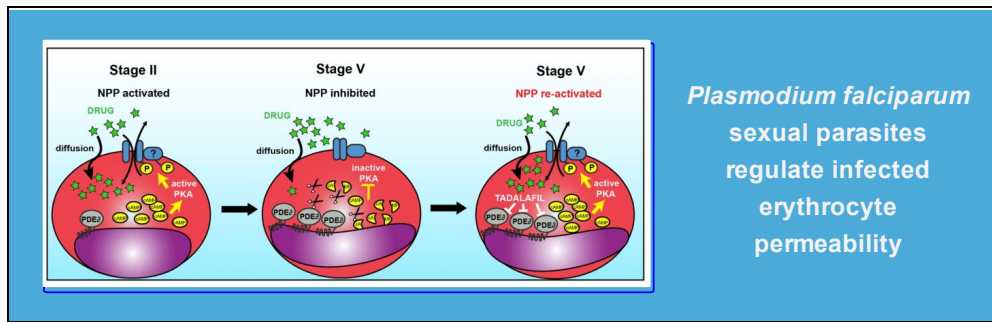


[Fola et al., 2020](#), described that population genetic analysis of malaria parasites requires high resolution genotyping tools that can accurately measure parasite diversity and relatedness and discriminate between populations within an endemic area. Fola and colleagues have developed a SNP barcode that captures the diversity of *Plasmodium vivax* populations of Papua New Guinea. This new genotyping tool measures diversity and population structure with greater resolution than the previously used microsatellite panel. Their results demonstrated how SNP barcodes, validated against the local parasite population, could generate critical insights into transmission dynamics to inform malaria control and elimination.

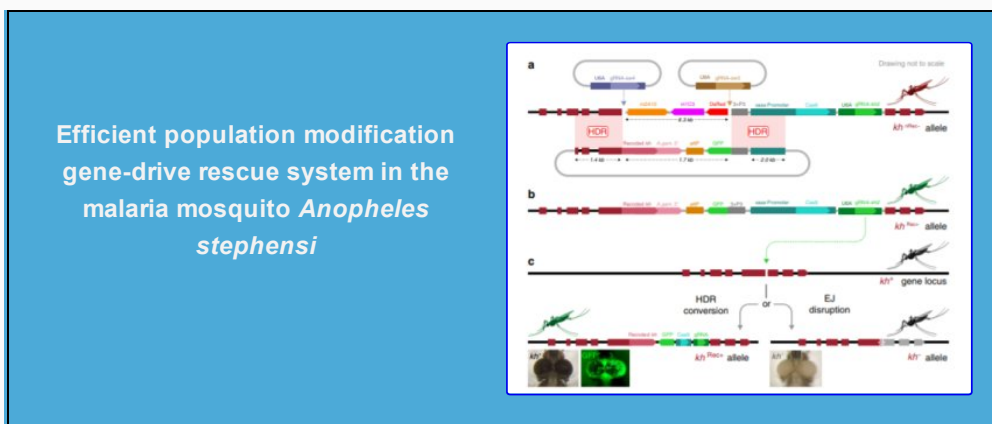
Asymptomatic recrudescence after artemether-lumefantrine treatment for uncomplicated falciparum malaria a systematic review and meta-analysis



[Mumtaz et al., 2020](#), described that AL, the most widely used treatment for uncomplicated *P. falciparum* in Africa, remains a highly efficacious drug in most endemic countries. However in the small proportion of patients where AL does not clear parasitemia, the majority of patients does not develop symptoms again and thus would be unlikely to seek another course of treatment. This continued asymptomatic parasite carriage in patients who have been treated may have implications for drug-resistant parasites being introduced into high-transmissions settings.



[Bouyer et al., 2020](#) characterized new permeation pathways (NPPs) in the pathogenic asexual parasite stages, however the existence of NPPs has never been investigated in gametocytes, the sexual stages responsible for transmission to mosquitoes. The authors showed that NPPs are still active in erythrocytes infected with immature gametocytes and that this activity declines along gametocyte maturation. Their results indicated that NPPs are regulated by cyclic AMP (cAMP) signaling cascade, and that the decrease in cAMP levels in mature stages resulted in a slowdown of NPP activity. The authors also showed that the uptake of artemisinin derivatives is facilitated by NPPs. Furthermore, NPPs can also get reactivated by phosphodiesterase (PDE) inhibitors, which in turn, increases the drug uptake in mature gametocytes. Such detailed mechanism can provide insights in to the roles played in *P. falciparum* gametocyte biology and its susceptibility to antimalarial drugs.



[Adolfi et al., 2020](#), developed a recoded gene-drive rescue system for population modification of the malaria vector, *Anopheles stephensi* that relieves the load in females caused by integration of the drive into the kynurenine hydroxylase gene by rescuing its function. The authors showed that the non-functional resistant alleles could be eliminated via a dominantly-acting maternal effect combined with slower-acting standard negative selection. Furthermore, it has also been shown through small cage trials that single releases of gene-drive males robustly resulted in efficient population modification with $\geq 95\%$ of mosquitoes carrying the drive within 5-11 generations over a range of initial release ratios.

Malaria Scientists to watch:

1. An interview with Dr. Madan Mohan Pradhan



Dr. Madan Mohan Pradhan, MBBS, MAE-FETP is presently working as the **Additional Director of Health Services, Odisha at ADPHO (VBD), Boudh district, Odisha.**

1. Please describe your research background and what has been the biggest motivation in your life that helped you to become a malaria scientist?

I am Dr Madan Mohan Pradhan having an MBBS background with masters in Field Epidemiology from the National Institute of Epidemiology- ICMR, Chennai. I am not a

pure researcher but a public health programme manager interested in programmatic researches. Most of my service years have been devoted in public health programmes in Odisha. I was instrumental in setting up of the post disaster Odisha Multi-Disease Surveillance System (OMDSS) with the initial support of Medicine Sans Frontier (MSF) to start with and then by WHO. The experiences of OMDSS gave me confidence to work on infectious diseases in higher scale and also motivated me to work on infectious diseases which are of public health concern for the state. After my masters training in the field epidemiology, I was given the assignment to lead public health programs at state level and for a long time, I provided technical support to the state's malaria control programme and other vector borne diseases. Later on as I got my seniority in the state's medical care, I was given the responsibility of the state program officer of state NVBDCP to lead the programme with both technical and administrative capacity. I had anger within me for malaria as I lost my mother in college days due to the infection with *P. falciparum* malaria leading to cerebral malaria. At that time most parts of Odisha were bleeding with the stings of this fatal mosquito borne disease. My personal sorrow, internal fighting spirit, passion on defeating the disease and technical knowledge and skill on field epidemiology moved to give in-depth attention in malaria control programme. In spite of doing all the best possible efforts within the national programme guidelines, malaria problem in Odisha was not bending down and perplexing me with causes of high transmission in many tribal and forested districts.

We conducted an operational research program– “Comprehensive Case Management” (CCMP) with funding support of Malaria Medicine Venture and technical support of National Institute of Malaria Research -ICMR, World Health Organisation and National Vector Borne Disease Control Programme. This project was conducted in different geotypes and malaria epidemiological settings taking both intervention and control blocks. This main aim of this project was to test T3 – test, treat and track. The project was conducted for five years since 2013.

The learning of this research project helped me to initiate the state specific malaria elimination programme in remote inaccessible villages where prevalence of malaria infection was very high and intense without manifestation of any fever.

2. What has been the most crucial impact of your research so far that is inspiring for young researchers?

Generally, the research findings do not get sufficient roots in guiding the public health programs in the field situation. The experiences and findings of CCMP stimulated me to build up a special state programme DAMaN (Durgama Anchalare Malaria Nirakaran) for elimination of reservoirs of malaria infection (afebrile malaria infections prevalent in endemic remote villages). I got the confidence that a new concept for malaria elimination in remote underserved villages could be understood by the state policy makers and administrators to support a new venture with state's funding. Hope this experience can motivate young researchers for new thinking in malaria research.

By reorienting the state malaria control programme, there could be very high impact on the malaria burden with the available malaria prevention/control tools; we can say it could be an example of "High Burden – High Impact". Malaria case were around 4.5 lakh in 2016 and due to the state specific intervention in 2017, there could be more than 80% case reduction i.e. around 39,000 malaria cases in 2019 and very few reported deaths limited to one digit.

Following publications have come out from CCMP:

a. Improved access to early diagnosis and complete treatment of malaria in Odisha, India. Sreya Pradhan, Madan Mohan Pradhan, Ambarish Dutta, Naman K. Shah, Pyare Lal Joshi, Khageshwar Pradhan, S. K. Sharma, Penny Grewal Daumerie, Jaya Banerji, Stephan Duparc., Kamini Mendis., Shiva Murugasampillay, Neena Valecha , Anupkumar

R. Anvikar- *PLOS ONE*, (January 2019).

b. Comprehensive case management of malaria: Operational research informing policy. MM Pradhan, Anupkumar R Anvikar, P Grewal Daumerie, S Pradhan, A Dutta, N K Shah, P L Joshi, J Banerji 3, S Duparc, K Mendis , S Murugasampillay, N Valecha- *Journal of vector borne diseases*, (March 2019).

c. Malaria elimination drive in Odisha: Hope for halting the transmission Madan Mohan Pradhan, PK Meherda- *Journal of vector borne diseases*, (March 2019).

3. What are research gaps that you think require urgent attention in eliminating malaria from India?

- . Health system gaps to sustain the positive experiences of malaria elimination in different parts of India
- . Inbuilt entomological surveillance system is the weakest link
- . Studies on the threats on insecticide resistance
- . Addressing malaria problems in the interstate border areas and inter-country border areas
- . Addressing malaria in deep forest areas, mining and industrial complexes

4. Finally other than malaria research, did/do you have any other research interests?

I have interests in following research areas:

- . Malaria & malnutrition and poverty cycle
- . Health system research
- . Socio-cultural determinants of local health problem
- . Panchayat health planning and the implementation of self-reliant public health programmes

2. An interview with Dr. Rajendra Kumar Baharia



[Dr. Rajendra Kumar Baharia](#) is currently working as ‘**Scientist B’ & Officer In-Charge at ICMR-NIMR Field Unit Nadiad Gujarat** where he primarily acts as a Principal investigator of Malaria Epidemiology and Vector biology and vector control related projects from extramural and foreign funding agencies.

1. Your origin story: Can you please describe your research background?

Like many biology students, I dreamt of becoming a medical doctor after school but destiny had something else for me. I got selected for the Ayurvedic stream. I did graduation from RAU, Bikaner, Rajasthan. I completed my Ph.D. from CSIR-CDRI, Lucknow, Uttar Pradesh (CSIR- Central Drug Research Institute) under the guidance of Dr. Anuradha Dube. My doctoral research was focused on characterization of Nucleosomal Histone Protein(s) and Th1 stimulatory proteins of *L. donovani* to explore their potential as a vaccine target against Visceral Leishmaniasis. During my PhD tenure, I gained expertise in techniques such as cloning, overexpression and purification of Th1 stimulatory proteins and Nucleosomal Histone proteins to assess their prophylactic potential against experimental visceral leishmaniasis, identified through proteomics. I had

also worked on drug/target discovery programme against visceral leishmaniasis, both *in vitro* and *in vivo* (hamster model). I submitted the following gene sequences to National Centre for biotechnology information (NCBI) Sequence database:

- . *Leishmania donovani* Gene sequences submitted in National Centre for Biotechnology Information (NCBI), Bethesda, MD USA (13 sequences).
- . Dengue Genome sequences submitted in National Centre for Biotechnology Information (NCBI), Bethesda, MD USA (28 Sequences).

2. What was the biggest motivation in your life that made you become a scientist?

Some of my colleagues are in IAS, IPS and IFS profession. However, from childhood, I always aimed to become a medical researcher. After completion of doctoral research, I joined as a research scientist in biomedical informatics centre at ICMR-DMRC, Jodhpur. I got selected for the post of Scientist-B at ICMR-NIMR New Delhi.

3. Enlighten us about your line of research and what has been the importance/impact of your research?

I am working as Principal investigator in various National and International research projects related to Malaria epidemiology and Malaria entomology. I recently completed the ICMR Task force project on vector Biology and vector behaviors in Gujarat, India. We did a continuous entomological surveillance for one year in the field. I found that the on going integrated vector management (IRS & LLINs) practices are more valuable for controlling malaria. Based on blood meal analysis of *An. culicifacies*, it was found to be mainly zoophagic. *An. culicifacies* was susceptible to alpha-cypermethrin insecticide which is presently used for IRS programme in villages. I also completed two studies 1. Study of economic burden of dengue and chikungunya infection in India. 2. Malaria in pregnancy. I am also actively involved as a site investigator in a new project on monitoring the efficacy of ACT for the treatment of uncomplicated *Plasmodium falciparum* malaria in India (TES 2020). Continuous monitoring of their efficacy is needed to inform treatment policies in malaria-endemic countries, and to ensure early detection of, and response to, drug resistance. Asymptomatic malaria especially due to low density infection and antimalarial drugs/ insecticides resistance is one of the major challenging issues to be tackled. Due to urbanization, studying the changing behavior of malaria vectors can also be challenging. I am also currently working on new projects to answer such challenging issues.

4. What got you interested in starting a career at ICMR-NIMR and how has been your journey till date?

After selection at ICMR, I was posted to ICMR-NIMR. My journey since then has been challenging. I am a molecular and parasite biologist. I was posted as the Officer in-charge & Scientist B at ICMR-NIMR Field unit, NADIAD, Gujarat. I had administrative and scientific responsibilities of field unit and worked in coordination with the Gujarat health department. But I was fortunate to have a very supportive staff, colleagues and a kind support from Director and also from Gujarat health department for smooth running of research projects.

5. Other than malaria research, did/do you have any other research interests?

I am interested in developing a laboratory according to WHO norms in the future. I have also completed the studies on Dengue virus. I will develop my lab for better molecular studies in future. I have completed laboratory investigation of primary health centres and

entomological surveillance of Chandipura virus in Kheda district. I have actively organised the training programme for District/ Taluka health supervisors of Gujarat health department in term of Malaria Microscopy and Medical Entomology.

6. Finally, on a lighter note, do you have any hobbies other than science that keeps you going on even during challenging times during your research career?

I like reading books, magazines and successful autobiographies of great scientists and great personalities. I also like to listen to the music and folk songs.

Scientific Achievements

Dr Manju Rahi and Dr Amit Sharma from ICMR-NIMR, New Delhi, India, had penned a valuable research article on Malaria Elimination entitled, 'For malaria elimination, India needs a platform for data integration', that recently got published in journal [BMJ Global Health](#), 2020, to describe the much needed transition from use of aggregated data to near real-time case-based epidemiological, entomological and commodity surveillance to pave the road to malaria eradication from India in the near future.



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