

MERA-India brings you...

NEWS & VIEWS

Issue 25, November 2022



INTERVIEW

Dr Hisham Moosan,
Scientist E,
ICMR-NIIRNCD, Jodhpur,
Rajasthan, India

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Editorial

Dear Readers,

MERA-India team brings you the twenty-fifth issue of our newsletter, "News & Views".

Artificial intelligence (AI) and machine learning (ML) are not just fancy words in current times but have emerged as major technological advancements touching each facet of our lives. The researchers and policymakers have highlighted the need to adopt AI-based approaches in various aspects of disease management including the building of more sensitive, robust and quicker diagnostics; devising personalized treatment plans for better patient outcomes; and overall improvements in the healthcare system. AI-based tools can also be used for predicting the outbreak of diseases using meteorological information.

For malaria, AI is still a less explored technology and its potential is yet to be utilized fully to address the challenges. Some of the challenges for which AI-based malaria-specific solutions can be built include inaccurate diagnosis, often in low parasitemia cases and the discrepancy in results due to varied skill levels of trained professionals; real-time reporting and monitoring of cases; and outbreak predictions especially linked to climate change. Building an image database of slide banks containing positive slides for each stage of *Plasmodium* species (including neglected species), and using those images as reference for microscopic diagnostics or for developing AI-based automated and user-friendly diagnostics will not only lead to robust malaria diagnostics but also expand the coverage of diagnosis and surveillance in areas with a shortage of skilled health workers. The use of drones for spraying insecticides, distribution of mosquito nets, and surveillance of the breeding sites can strengthen the vector management system, which can help in controlling not just malaria but other vector-borne diseases as well.

As World Health Organization (WHO) marked World Malaria Day 2022 under the theme "Harness innovation to reduce the malaria disease burden and save lives," AI-based approaches can help to bring the world closer to the goal of malaria eradication. MERA-India also realizes the potential of AI-based solutions for accelerating the efforts toward India's malaria elimination goal. In this context, MERA-India invited researchers to submit proposals for funding during its second call for proposals under the theme "Artificial Intelligence (AI) Surveillance, Remote Sensing, Digital Platform for Surveillance, GIS Nodes Identification, Mobile apps."

In continuation with our capacity-building initiatives for young researchers, MERA-India organized the "Basic Mosquito Biology Training" last month to spread awareness about entomology, and a glimpse of the event can be found in the current edition of the newsletter under the section "NIMR & MERA-India activities". This month's release also brings the highlights from the distinguished lecture by the renowned WHO scientist, Dr Raman Velayudhan (Head of Veterinary Public Health, Vector Control and Environment unit in the Department of Control of Neglected Tropical Diseases at World Health Organization, Geneva, Switzerland).

In the current edition, we also bring to you the inspiring and informative interview of Dr Hisham Moosan, Scientist E, ICMR-National Institute for Implementation Research on Non-Communicable Diseases (ICMR-NIIRNCD). Some of the latest malaria research papers, looking into the new care pathway for the treatment of *P. vivax* malaria; the effect of co-infection of four *Plasmodium* species on the density and gametocyte carriage; and the effect of integrated vector control on the asymptomatic and sub-microscopic *Plasmodium* infection in western Kenya, have been highlighted under the section “Research in Spotlight”.

In this edition, we are introducing a new section, “Malaria Through the Lens of Researchers” to showcase the original images from the PhD/MD students and postdocs working in India. These images were submitted for the MERA-India image competition for which the results were announced on the occasion of the ICMR-National Institute of Malaria Research (ICMR-NIMR) annual day and have been shared in this edition.

We hope that this issue will be more engaging and fascinating for you. Please write to us for any feedback or suggestions regarding the content of the newsletter at meranewsletter@gmail.com.

With best wishes,
MERA-India team

ICMR-NIMR & MERA-India Activities:

Distinguished Lecture by Dr Raman Velayudhan

The screenshot shows a Zoom meeting interface. The main content is a presentation slide from the World Health Organization (WHO) and the Tropical Disease Research Programme (TDR). The slide is titled "EFFECTIVE VECTOR CONTROL" and features a central diagram with six hexagonal icons representing Sustainable Development Goals (SDGs): 1 (No Poverty), 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), 11 (Sustainable Cities and Communities), 13 (Climate Action), and 17 (Partnerships for the Goals). The slide lists several opportunities for vector control:

- Recognition:** importance exemplified in existing regional and global vector-borne disease control strategies
- Expansion:** build on successes against malaria, onchocerciasis and lymphatic filariasis
- Optimization:** re-align across multiple vectors, diseases, sectors and partners
- Collaboration:** leverage existing networks for information and resource sharing
- Adaptation:** create flexible systems to address specific conditions and challenges
- Innovation:** new tools, technologies and approaches on the horizon
- Technology:** advances in data collation, planning and implementation
- Development:** alignment with Sustainable Development Goals

The meeting interface includes a top bar with participant thumbnails (IT NIMR, ICMR-NIMR, 1st year M.Sc PHE IC..., Raman Velayudhan, Ashwani Kumar, 2nd Year M.Sc. PHE S..., Dr Vikas) and a bottom bar with controls like Unmute, Start video, Share, and a red 'X' button.

Last month, in October 2022, we had the privilege of having Dr Raman Velayudhan as a speaker in the ICMR-NIMR & MERA-India “Distinguished Lecture Series”. Dr Velayudhan is at present Head of the Veterinary Public Health, Vector Control and Environment unit (VVE) unit, the Department of Control of Neglected Tropical Diseases of World Health Organization (WHO), Geneva. He is the global focal point for dengue prevention and control, Integrated Vector Management and coordinates other arboviral vector-borne disease control activities at WHO. In his present assignment, he also supports the secretariat for the Vector Control Advisory Group. Dr Manju Rahi, Director-in-Charge, ICMR-NIMR, welcomed Dr Velayudhan, and Dr Sachin Sharma, Chief Consultant, MERA-India, introduced the speaker to the attendees.

Dr Velayudhan’s lecture was entitled “Global Vector Control Response - the last window of opportunity for vector control”. In this insightful lecture, Dr Velayudhan presented the current global scenario, challenges, possible solutions and new innovations for the control of vector-borne diseases. He highlighted that 80% of the world population is at risk of vector-borne diseases, which contribute to 17% of communicable diseases, and that none of the continents is free of vector-borne diseases. He further mentioned that major gains in malaria control have been achieved because of the interventions targeting vector control. He gave an overview of the vision and aims of Global Vector Control Response (GVCR) and described in detail how the emerging challenges such as invasive vector species, climate change, urbanization and water crisis could increase the risk for vector-borne diseases, and what could be the possible solutions to tackle these issues. He also talked about the Vector Control Advisory Group (VCAG) convened by WHO for all vector-borne

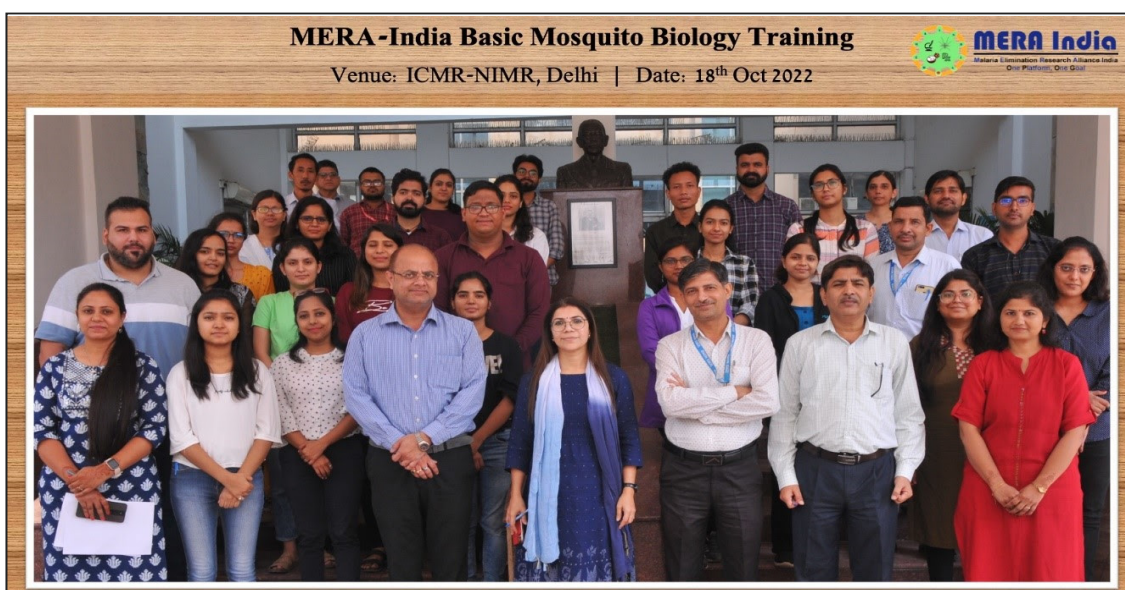
diseases to assess the public health value of new vector control interventions. He concluded the lecture by describing the new tools for vector-borne diseases including

The lecture was followed by Dr Velayudhan's answers to the questions from the lecture attendees. The session concluded with Dr Manju Rahi and Dr Sachin Sharma thanking the speaker and the attendees.

The recording of this lecture is available on the MERA-India website (<https://www.meraindia.org.in/lecture-series>).

MERA-India Basic Mosquito Biology Training 2022

To spread awareness about entomology and encourage young researchers to pursue this field, MERA-India organized a Basic Mosquito Biology Training for PhD students of Delhi/NCR region on 18th October 2022 at ICMR-NIMR, New Delhi. The applications for the training were invited from students, and young researchers from the institutes/universities in the Delhi/NCR region.



The training included an insightful lecture from Dr K. Gunasekaran, {Former Scientist-G, ICMR-Vector Control Research Centre (ICMR-VCRC), Puducherry}, in which he introduced the participants to entomology and its importance in understanding disease dynamics and control. Dr Himmat Singh (Scientist E, ICMR-NIMR) described the role of mosquitoes as vectors and described the morphology, developmental stages, breeding sites, etc., of the various mosquito species responsible for life-threatening diseases like malaria, dengue, etc. After the briefing about the behaviour and life cycle of the mosquitoes, Dr Rajnikant Dixit, (Scientist E, ICMR-NIMR) highlighted the various molecular aspects of mosquito biology i.e., olfactory system, reproductive system, microbiota, etc., and demonstrated the use of membrane feeding assay.

MERA-India Basic Mosquito Biology Training

Venue: ICMR-NIMR, Delhi | Date: 18th Oct 2022



ICMR-NIMR insectary visit along with the demonstration of mosquito developmental stages, species identification, male-female identification, and tissue dissections were also conducted to provide a practical experience with mosquito handling and research. Dr Vaishali Verma (Technical Officer B, NIMR) demonstrated insecticide susceptibility assays to determine the resistance in mosquitoes. The participants also interacted with the NIMR scientists and staff to get answers to their queries.

MERA-India Basic Mosquito Biology Training

Venue: ICMR-NIMR, Delhi | Date: 18th Oct 2022



A quiz session was also organized in which the young researchers participated actively.

MERA-India Basic Mosquito Biology Training

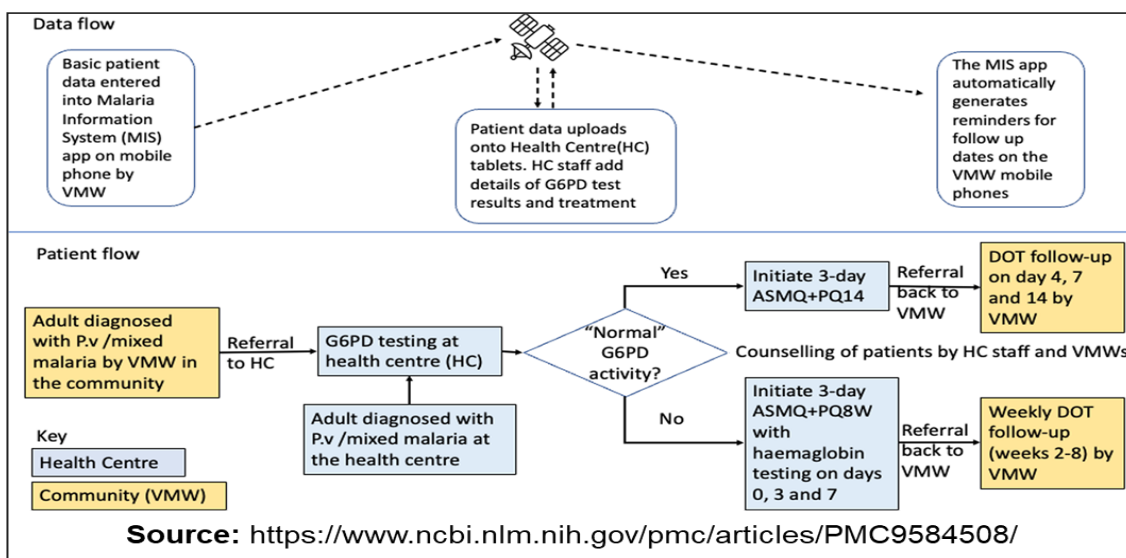
Venue: ICMR-NIMR, Delhi | Date: 18th Oct 2022



In the end, all the participants were given certificates for attending the in-person training by Dr Rajnikant Dixit, Dr Himmat Singh and Dr Vaishali Verma. The training facilitators were also presented mementos by Dr Sachin Sharma (Chief Consultant, MERA-India).

Research in Spotlight

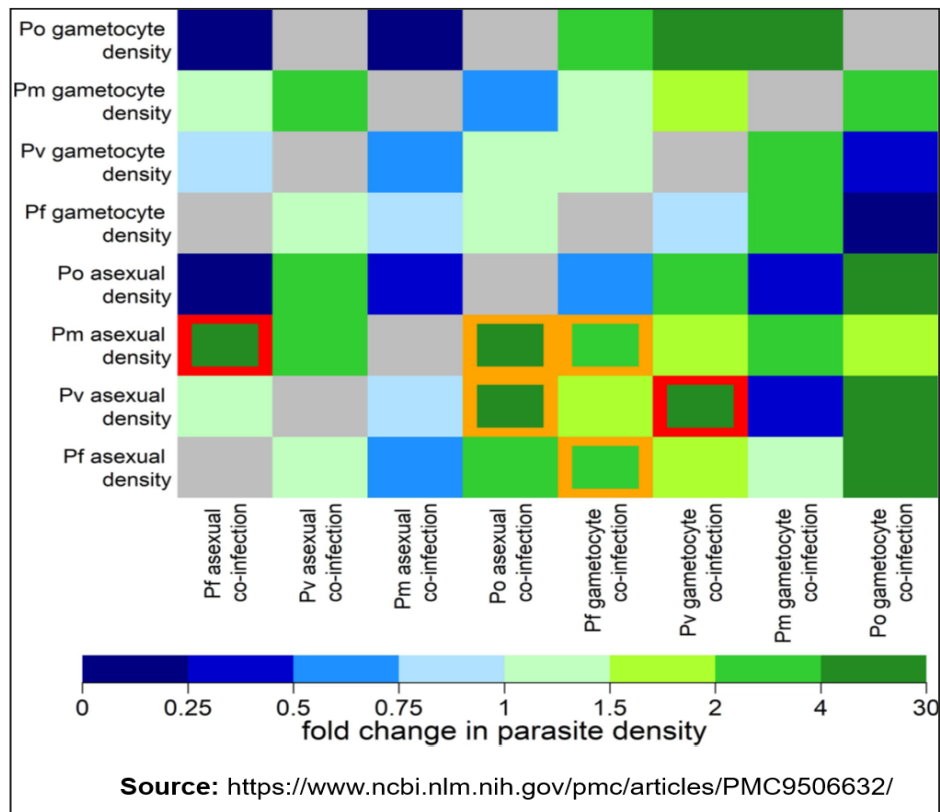
Kheang ST. *et al.*, *PLoS One*. 2022: G6PD testing and radical cure for *Plasmodium vivax* in Cambodia: A mixed methods implementation study



Cambodia is targeting malaria elimination till 2025. As the Cambodian-Thai border has been the epicenter of multidrug-resistant *P. falciparum*, most interventions were focused on *P. falciparum* malaria cases and their transmission. Because of this, they have successfully reduced the burden of *P. falciparum* malaria. But as the *P. falciparum* cases decline, the next major concern for achieving the goal of elimination is *P. vivax*. The regular ACT treatment is ineffective on the dormant form of the *P. vivax* parasite *i.e.*, hypnozoites, hence “radical cure” is required to treat these patients. Usually, a 14 days primaquine treatment is given to patients with *P. vivax* infection, but this cannot be followed with patients having G6PD deficiency, which results in the burden of relapses. G6PD (Glucose-6-Phosphate Dehydrogenase) deficiency plays a crucial role in radical treatment, as G6PD deficient patients have the risk of severe hemolysis. The beginning of point-of-care testing for the deficiency of G6PD has increased the possibility of a radical cure.

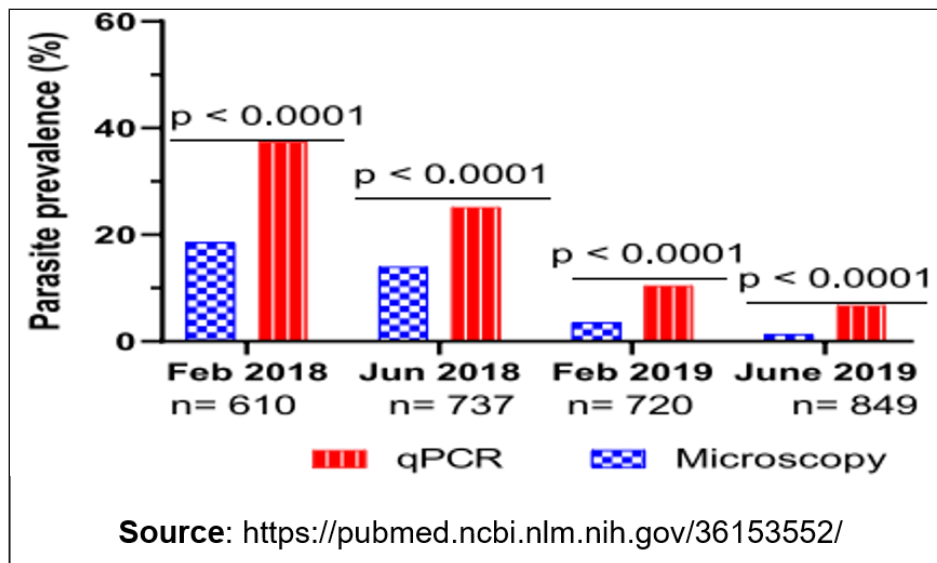
In the present implementation [study](#), the authors have co-developed new care pathway interventions with the key stakeholders at the local, district, and national levels and executed them in the Pursat province of western Cambodia. At first, the patients with *P. vivax* infection were referred by the Village Malaria Workers (VMWs) to the local health centers for G6PD testing, where depending on the G6PD status, the patients were given 14-day (for normal G6PD patients) or 8-week (patients with G6PD deficiency) primaquine regimens radical cure. After that, follow-ups were carried out by VMWs on days 3, 7, and 14. The authors have also followed supporting interventions, which include community sensitization, proper training, and the development of tablets/smartphone applications to support follow-ups, referrals, and surveillance. This new care pathway was found highly acceptable by the community and successful in the Pursat setting, as they have a strong network of VMWs. Currently scaling up of this *P. vivax* radical cure programme is underway in Cambodia, which is bringing *P. vivax* cases down and hence making them closer to the elimination goal.

Holzschuh A. et al., *PLoS Negl Trop Dis.* 2022: Co-infection of the four major *Plasmodium* species: Effects on densities and gametocyte carriage



While co-infections with the different *Plasmodium* species {*P. falciparum* (*Pf*), *P. vivax* (*Pv*), *P. malariae* (*Pm*) and *P. ovale* (*Po*)} have been reported, the within-host inter-species interactions during the co-infections and the effect of simultaneous infections by multiple species on the gametocyte production and transmission potential of the individual species is not well understood. In this [study](#), the authors performed molecular diagnosis for detecting asexual and gametocyte stages of the four *Plasmodium* species: *Pf*, *Pv*, *Pm* and *Po*. While a lot of research and tools are available for *Pf* and *Pv*, the diagnostic tools for *Pm* and *Po* are lacking. This study has thus reported a new molecular diagnostic method for the detection of *Pm* and *Po* gametocytes. The authors used these assays to look into the inter-species interactions during the co-infections of these four *Plasmodium* species in samples collected from children aged 5-10 years in Papua New Guinea, where a high transmission of all four species has been observed. Pairwise interactions were analyzed to look into the parasite and gametocyte densities during the co-infections. The authors report that the frequency of co-infection with *Pf* and *Pv* asexual or gametocyte stages was higher than that expected from the individual species infections. Further, triple infections with *Pf*, *Pv* and *Pm* species were observed to be four times more frequent than expected. Also, *Pm* had higher parasite densities and gametocyte numbers during co-infections, particularly with *Pf*, indicating that co-infections with other *Plasmodium* species provide a transmission advantage to *Pm*. The study thus provides new insights into the in-host inter-species interactions between the four major malaria parasites during co-infections.

Omondi CJ. et al., *Malar J.*, 2022: Asymptomatic and submicroscopic *Plasmodium* infections in an area before and during integrated vector control in Homa Bay, western Kenya



In this [study](#), the authors assessed the effect of long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) on the prevalence of asymptomatic and submicroscopic malaria parasite infections in Homa Bay County. From February 2018 to June 2019, four cross-sectional surveys were undertaken for *Plasmodium* infections in the endemic region. Both microscopy and quantitative polymerase chain reaction (qPCR) revealed a significant decline in parasite infection rates among the study population. During the study period, the prevalence of asymptomatic and symptomatic patients decreased. It was also observed that parasite prevalence was highest in the participants age range 5–14 years old. The authors observed that the absolute number of asymptomatic and submicroscopic infections decreased over the study period, but the relative proportion of these infections increased. The findings of this study will aid health policymakers in improving malaria control and management strategies.

Malaria Scientist to Watch: An interview with Dr Hisham Moosan



[Dr Hisham Moosan](#)

Scientist E

ICMR-National Institute for Implementation Research
on Non-Communicable Diseases, Jodhpur, India

1. Please share with our readers your journey and experiences from being a young science student to your current position as Scientist at ICMR-NIIRNCD.

After a few years of being a doctor in various private settings, I joined the Kerala Health Services in Wayanad district in late 2009, which is where I had my first, and probably the best exposure to the public health system a young doctor could get. The stint motivated me to pursue an MD in Community Medicine, after which I gained employment as an Assistant Professor in GMC Palakkad, then as a Technical Expert - Epidemiologist and Project lead for a Department of Health Research project intended to set up a Regional Technical Resource Centre for Health Technology Assessment, in SCTIMST, Trivandrum, and finally went on to become a faculty in DM Wayanad Institute of Medical Sciences, right in the middle of the raging COVID Pandemic. Working in ICMR now, I feel that this mosaic of experiences in different domains of health care has been integral in my ongoing process of trying to evolve as a public health professional.

2. How important is community participation in malaria control and prevention?

From a public health perspective, community participation is integral to achieving optimal (if not absolute) control and prevention of malaria in the country. But, it has often occurred to me that we may be approaching this the wrong way, considering that the focus of the health education strategies regarding malaria and a whole lot of other diseases is more on the dissemination of information rather than on creating demand for these services, as the ultimate goal. Generation of this demand among the community should be the real objective of these efforts, which can ensure sustainable community involvement.

This doesn't mean that I am not in favour of the routine IEC strategies that have been deployed so far. On the contrary, my suggestion is more directed towards being cognizant that this demand drive generation is a key factor in effecting behaviour change, which is actually the end-point of most of these efforts in the first place.

3. Based on your experiences, please share your opinion on how advances in digital technologies will help in malaria surveillance in India.

The advent of digital technologies has definitely opened up a whole lot of avenues for improvement in public health surveillance. But it seems that we have a long way to go in cashing in on these digital opportunities. For example, the creation of a robust digital reporting system all over the country for the surveillance of malaria and other vector-borne diseases is something that still lacks in the country. The extant system, still extensively paper-based, only aggregates this data into the larger database. As opposed to this, a surveillance reporting system that supports real-time reporting of data in a uniformly reorganised format would be invaluable to various disease control programs, including that of Malaria.

Another example is the advent of Geographical Information Systems (GIS), which has opened up opportunities in the domain of spatial epidemiology. Akin to the prediction of things like the weather, something as apparently simple as the potential of a person to be infected with malaria is dependent on a variety of social, environmental, economic, behavioural and contextual factors interacting in various degrees of magnitude, at various levels. SEAMER (Spatial Epidemiological Approach to Malaria Elimination Research) is one of the studies being conducted by ICMR-NIIRNCD with MERA-INDIA, which is underway on similar lines involving data collection from partner institutions across eight states in India. I feel that there is great room for improvement in utilizing the exponential growth in advancement, availability and feasibility of digital technologies in improving disease surveillance.

4. What do you think are some of the major challenges for India to eliminate malaria?

A major challenge is the extremely variable nature of the environmental and socio-economic contexts across India. The complex and dynamic nature of the behavioural factors and how they interact with the systemic factors (that may constitute both the health system and societal ones) are hurdles for both the operational and research aspects of the public health system. Be it more specific factors like increasing drug resistance, poor vector control, and challenges in surveillance; the magnitude and spread of these are intricately linked to regional contexts. In my opinion, these pose ideal opportunities for mixed-methods research, especially from an implementation research point of view, wherein the axis of inquiry is largely focused on addressing the “know-do” gap using both qualitative and quantitative approaches, as required.

5. What significance do you see for MERA-India in achieving India's malaria elimination target?

By identifying actual research gaps in consultation with the different stakeholders and promoting research in key areas that need to be improved with respect to the prevention and control of malaria, MERA-India will be instrumental in being a strong advocacy force in the health policy arena. This in turn would be crucial in prioritising malaria in the health policy agenda of the country and its states. Extensive community participation, robust efforts from the public health system, and a strong notion about the importance of controlling malaria among policymakers are probably the key forces that will help eliminate this disease from the country.

Malaria Through the Lens of Researchers

To highlight the images and significance of images in science and research, MERA-India organized an image competition for which original images or photographs related to malaria are invited from PhD/MD students and postdocs working in India.

We received a large number of entries from all over India, and an exhibition of the shortlisted images in the competition was held on the occasion of ICMR-NIMR Annual Day 2022, on 01st November, at ICMR-NIMR, New Delhi.



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MERA-India Image Competition 2022
Venue: ICMR-NIMR, Delhi | Date: 01st Nov 2022

Based on the scores from the judges, the following entries were declared as the top three in the MERA-India Image Competition 2022!

First Prize: Ms Suman Lata, PhD student, ICMR-NIMR, New Delhi

Image caption: *Anopheles stephensi* key breeding sites in rural areas of Western Rajasthan

Second Prize: Ms Aastha Varshney, PhD student, CSIR-CDRI, Lucknow

Image caption: Malaria parasite infected liver cell showing DNA ligase expression in nucleus

Third Prize: Dr Renuka S, Postdoctoral Fellow, NIMR-Field Unit, Bengaluru

Image caption: *Beauveria bassiana* - A slow but steady vector control tool for malaria vector, *Anopheles stephensi* (Culicidae)

We congratulate all the winners and thank all the students, researchers and clinicians who submitted their work for this competition, and their supervisors/department heads for supporting the participation of their students.

All the images received for this competition will be highlighted in the MERA-India newsletter issues in this section on “Malaria Through the Lens of Researchers”.

In this issue, we are highlighting the **winning entry of the competition**, entitled “*Anopheles stephensi* key breeding sites in rural areas of Western Rajasthan”.



This image was submitted by Ms Suman Lata, PhD student with Dr Himmat Singh in the Vector Biology group at, ICMR-National Institute of Malaria Research, New Delhi.

A brief description of the image is as follows:

The picture was taken at Ajasar near Ramdevra Pokhran Rajasthan during the preliminary survey of the village for the breeding of *An. stephensi* in underground tanks. These underground tanks are known as “tankas” and are present in each house at the place shown in the picture above, sometimes also inside the larger houses. If the lids are not proper in underground tanks *An. stephensi* breed in these tanks and bite the inhabitants living around them. The other breeding sites in the month of May–June are not available except for underground tanks. The study was conducted to assess breeding in these tanks and to prevent breeding by placing proper modified polyvinyl lids. This study was conducted with the help of villagers they cooperated with and they changed around 262 lids of the whole village as a result of which there was no breeding observed in these tanks after one year and setting a good example of community participation (the same was published in 2021 by Singh *et al* in Malaria Journal). The picture is showing the system of malaria transmission through *An. stephensi* in the extreme western region of Rajasthan, India. All the components of malaria transmission can be seen in this picture: vector breeding site, host and resting site.



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