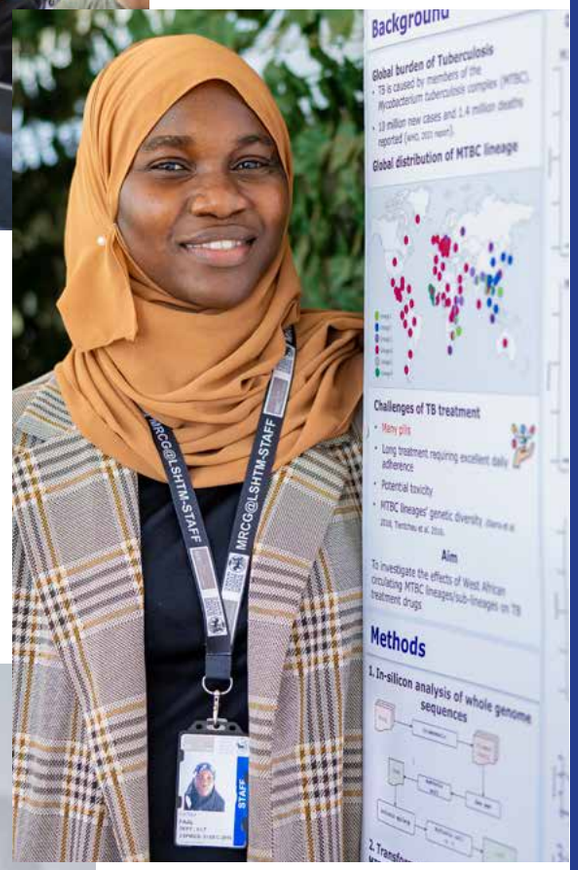
Malaria Centre

2022-24

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Malaria centre



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Foreword

The last few years have been a testament to the resilience of our malaria research community.

Malaria remains a devastating disease across many endemic countries, particularly in sub-Saharan Africa. The progress in reducing transmission at the start of this century has stalled and we are now seeing increases in some settings. Coupled with a threat to the necessary funding levels and worryingly numerous reports of drug resistance, failures in diagnostics, and invasive mosquitoes bringing outbreaks to areas with previously low transmission, the situation could feel quite bleak. However, the last couple of years have seen some exciting developments in the world of malaria research and control, many of which have involved Centre members and our collaborators.

We now have two WHO-recommended efficacious malaria vaccines being rolled out in a historical and game-changing approach in the fight against malaria. Whilst it may not be a silver bullet, it will provide crucial protection to millions of children and save many lives. Further research into delivery strategies and target populations are ongoing and will likely further increase the numbers protected by these ground-breaking vaccines. Following changes in WHO policy recommendations in 2023, next-generation bed nets are now being distributed in areas where mosquito vectors have become resistant to standard nets. These changes will likely lead to considerable declines in malaria cases in high-risk regions.

These important milestones have been achieved through a concerted global effort to leverage scientific innovation, improve healthcare infrastructure, and implement effective public health strategies, all of which are driving progress towards the goal of malaria elimination.

For the past two years, the Centre has focused on strengthening our sense of community to foster collaboration and inclusivity. Through strategic activities, we have successfully reignited the sense of camaraderie and shared purpose that is essential for groundbreaking research. Our revitalised community spirit is particularly evident in our early career researchers (ECRs), who have been integrated into key Centre activities through student showcases, training sessions, networking events, and the organisation of our retreat. As part of our 25th anniversary celebrations, we are proud to have launched an ECR fund, which has supported members to attend conferences, buy equipment and reagents, and register to external training courses, thereby championing the next generation of malaria scientists.

More broadly, we have brought members together during regular events including research seminars, social gatherings, annual retreats, and workshops. The Centre launched the Malaria Centre Knowledge Exchange Series, featuring bilateral and hybrid seminars with international collaborators, participated in the LSHTM Global Health Lecture Series, brought together experts in vaccines to hear about the innovative research in the field for all malaria species, and fortified our connections with members at the Medical Research Council Unit The Gambia through dynamic interactions and engaging hybrid events.

This brochure provides snapshots of some of the ongoing work of the Malaria Centre members, highlighting their wide breadth of expertise, spanning from malaria parasite and vector biology to human and environmental factors.

Confronted by a disease which continues to evolve and impact millions of lives each year, LSHTM's Malaria Centre plays a vital role in our mission to improve health and health equity worldwide.

The last few years have been a testament to the resilience of our malaria research community: when facing setbacks, we unite stronger, turning challenges into catalysts for breakthroughs. We are excited to see where this drive takes us in the next two years.

LSHTM researchers are continually seeking novel approaches to reduce cases and deaths, from major contributions to the development and rollout of the world's first malaria vaccine, to influencing WHO policy on the type of insecticide used on bed nets. Great progress has been made, but we face new and complex challenges such as drug-resistant pathogens, disrupted environments and climate change, and some previously hard-won gains are now under threat.

Close collaboration with our global partners, working together in mutual trust and respect, and our shared research community, are more important than ever in our aim to eliminate malaria worldwide.

Professor Liam Smeeth
Director of the London School of Hygiene & Tropical Medicine

Jackie Cook
Associate Professor in Malaria Epidemiology and Malaria Centre co-Director

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Associate Professor in Malaria Pathogenesis and Malaria Centre co-Director

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Malaria Centre Coordinator

Mamud Joof
Communications Officer

Our story

We're the Malaria Centre at the London School of Hygiene & Tropical Medicine. Founded in 1998, we're a global network of over 450 researchers, postgraduate students and support staff working together in 50+ countries around the world.

The story of malaria is still being written. The constant battle between people and this persistent disease features throughout so much of human history – sometimes we've had the upper hand, and sometimes not. While important achievements have been made over the past 30 years and the global burden has been dramatically reduced, evidence shows us that we're losing ground, and these hard-won gains are now under threat. Malaria continues to prevail, too many lives are still being impacted and too many lives are still being lost. It's a disease with complex levels and layers, with many factors contributing to its ever-changing and rapid evolution including human behaviour, economic, social and political upheaval, the effects of poverty, drug-resistant pathogens, the role of the vector, disrupted environments and climate change.

Humanity has made great progress over the years, saving and improving many lives, eliminating malaria in dozens of countries, making powerful breakthroughs, and finding new ways to work together for greater effect.

But we know if we take our foot off the accelerator, even for a moment, malaria comes surging back. The effect of the global pandemic is a prime example, showing us just how quickly progress can be reversed. At the Malaria Centre, we know that now is the time to dig deeper and push harder than ever before.

That's why we've dedicated our work and ourselves to the acceleration of progress in the fight against malaria. As an international teaching and research institute, our members work across education and research, informing policy change and translating new knowledge into tools and technologies that drive us forward. We do what we do at the Malaria Centre because ultimately, we believe human ingenuity and adaptability will help us get ahead of malaria.

Our work is driven by three key principles:

Powered by a rich mix of expertise

If we're going to be adaptable enough to get ahead of malaria, we know we'll need the powerful creativity that only comes from interdisciplinary and multidisciplinary ways of working. To spark new ideas, leap ahead and out-manoeuvre this complex disease we'll need more minds, more perspectives, more lived experience, and more people working on different aspects of the challenge. Getting ahead of malaria demands many angles of attack and the richest mix of expertise. And we need to keep growing that mix by training the next generation of malaria researchers and collaborators to bring fresh energy and zeal to drive us forward in the fight against the disease.

Driven to connect and inspire change

To accelerate progress in the fight against malaria we need to make even more of our growing, global network of colleagues and collaborators. New ideas can come from anyone and anywhere, that's why we're committed to being a pivotal connector and an open partner, committed to inspire change. That means reaching out further and finding new and better ways of working with one another, wherever we are in the world. It means learning from lived experience to break down barriers. It means listening, responding and challenging power dynamics to promote equity and equality across the malaria research community.

Building on a journey of 125 years

We're not starting from a blank page at the Malaria Centre. We're fortunate to have very tall shoulders to stand on that help us see further than ever before. In everything we do we leverage the solid foundations of LSHTM's 125-year journey of discovery to launch us forward to deeper understanding, better insight, further breakthroughs and accelerated progress.

Research at a glance

In 2022-24, we have...

630

Co-authored over 630 publications

400

Grown to over 400 members

£50

Received nearly £50 million in funding for our work

27

Been supported by 27 different funders

Our global reach

We strive to foster equitable partnerships with a common aim to accelerate progress against malaria. This map highlights the global reach of our network and countries where we collaborate on research.

Our community

Collaboration

The Centre serves as a central network to foster internal and external collaboration. We recently launched a Knowledge Exchange series, partnering with research institutions worldwide to disseminate impactful research findings and facilitate scientific partnership. To arrange an exchange, email us at **malaria@lshtm.ac.uk**.

Conferences

Over the last two years, Malaria Centre members attended numerous conferences across the globe, including the Multilateral Initiative on Malaria Society 8th Pan-African Malaria Conference, the Annual Meetings of the American Society for Tropical Medicine and Hygiene, the Pan-African Mosquito Control Association Annual Conference, the Molecular Approaches to Malaria Conference, the British Society for Parasitology, and more. Our members participated in over 100 panel discussions, oral presentations, and poster sessions.

Support for early career researchers

The Malaria Centre is incredibly proud of our Early Career Researchers and is committed to giving them the tools and opportunities to be the future leaders of malaria research. Over the last 2 years, the Centre Early Career Researcher Fund has sponsored multiple members to attend conferences and short courses, and hosted career development training for CV and professional biography guidance, tips for finding funding and grant and fellowship application support.

Malaria Centre UK Retreat

The annual Malaria Centre retreat brings our members together for two days of presentations, workshops, and networking.

In this hybrid event, members present exciting new research, bond with colleagues, and discuss important cross-cutting issues including decolonising the Centre, teaching support, equitable research partnerships, and the future global malaria research agenda.

MRCG Malaria Retreat

In February 2024, the Malaria group at the MRC Unit The Gambia held an exciting 2-day retreat bringing together researchers and stakeholders to discuss advancements and challenges in malaria control.

The event kicked off with visits to key malaria research labs and the official inauguration of a new insectary, followed by oral presentations on cutting-edge research such as mass vaccination trials, vector biology, and malaria genomics. The retreat also featured poster presentations and competitions highlighting innovative diagnostic tools, vaccine trials, and studies on drug resistance. Junior scientists participated in an “Elevator Talk” competition, showcasing their research in brief presentations.

Teaching

As a leading teaching institution, we have the privilege to train the next generation of malaria experts.

In addition to supervising PhD students, malaria teaching content reaches hundreds of MSc students through a combination of modules spanning multiple programmes.

At LSHTM we offer two malaria-specific modules, including ‘Malaria: from science to policy and practice’, with topics including disease transmission and epidemiology, tools for control and threats to efficacy, measuring impact, malaria in pregnancy, vaccines and health economics. The module has been running for over 30 years and includes lecturers from across departments and disciplines. We also offer a distance learning module ‘Malaria’ aimed at health professionals and scientists looking for a broad introduction to malaria biology, disease dynamics, and control. Around 80 students enrol in this each year, with over a quarter from malaria-endemic countries.

In 2023, the Malaria Centre led a review of all malaria-related teaching content to streamline materials and ensure broad coverage of key topics, as well as to decolonise the curriculum. The Centre helps module organisers recruit lecturers and teaching support, as well as updating teaching materials with the latest advances in current research and identifying new areas of interest to students.

Our Centre members also love to encourage future generations of scientists through junior work placement programmes. We invited students to shadow in our laboratories and insectaries and introduced them to the exciting field of infectious disease research. We hope to see them back someday as MSc students and researchers!

Malaria Centre Seminars

The Malaria Centre organises seminars with internal and external speakers throughout the year, presenting cutting-edge research in real time. Malaria research is interdisciplinary, so we often work with other Centres to highlight cross-cutting research.

In honour of World Malaria Day and World Immunisation Week 2023, the Malaria Centre and the Vaccine Centre at LSHTM co-hosted a hybrid seminar to discuss the latest advancements in malaria vaccine development. Later that year, the R21/Matrix-M vaccine became the second WHO-approved malaria vaccine for *Plasmodium falciparum*. Centre members also presented their ongoing work with the MultiViVax and OptiVivax consortiums for the first Phase II trial of a vaccine candidate for *Plasmodium vivax* malaria.

Antimalarial resistance undermines malaria control efforts. Whilst numerous antimalarial drugs have been introduced for prevention and treatment over the last few decades, malaria parasites are constantly evolving mechanisms to evade them. In a joint seminar with the Antimicrobial Resistance Centre at LSHTM, Centre members presented their surveillance of molecular markers of resistance and the implications for antimalarial interventions in Africa. Malaria Centre members also present their work in the school-wide Global Health Lecture Series, departmental seminars and external events.

“I look forward to the Centre Seminars because I always walk away having learned something new and exciting. With a disease that’s constantly evolving, it’s important for us to stay alert and keep driving new ideas.”

Ana Chopo Pizarro
Research Assistant

Media and public engagement

Malaria Centre members are often called upon to provide expert advice to policymakers, media, and stakeholders across the globe. The past two years have seen amazing developments in malaria research and our members' contributions have been recognised in worldwide media.

How many times has our work been mentioned in broadcast, print, and online media?

2,872

in 2022

2,066

in 2023

1,133

in 2024 as of October

New insecticide could save millions of lives from malaria

The Telegraph

MRCG vaccine trials reduced malaria cases by two thirds

The Standard Gambia

An invasive mosquito threatens catastrophe in Africa

The New York Times

The researcher versus the mosquitoes

Gates Foundation

Public engagement

Centre members engage with parliamentarians, ministers of health and finance, civil servants, and other political leaders in the UK and abroad to discuss the latest challenges facing malaria control and the important role of political support in achieving malaria elimination globally.

We also work with grassroots organisers, community leaders and passionate advocates to share evidence-based messages about malaria prevention and control.

UK
Malaria Centre members contributed expert comment for an APPG roundtable and report on diagnostic and drug resistance challenges.

The Gambia
Publicity on the opening of the new insectary at The MRC Unit The Gambia at LSHTM.

Côte d'Ivoire
A district health official working with the Plus Project met with religious leaders in Abengourou, Côte d'Ivoire to discuss perennial malaria chemoprevention.

UK
RAFT Consortium members presented research to the All-Party Parliamentary Group on Malaria and NTDs (APPG) on invasive mosquito species *Anopheles stephensi* and the threats it poses to malaria control in sub-Saharan Africa.

India
Researchers from the India ICEMR collaboration presented key findings to local and regional health officials.

Some media outlets we've been featured in:

The New York Times
Forbes
The Guardian
BBC WORLD NEWS
The Telegraph
FINANCIAL TIMES
REUTERS

World Malaria Day

Alicia Showering

Kallista Chan

Freddy Sarathchandra

Three LSHTM early-career researchers were photographed by acclaimed artist Rankin in a portrait series published in The Telegraph for World Malaria Day 2023. Rankin, known for portraits of figures such as Madonna, David Bowie, and Queen Elizabeth II, wanted to capture different kinds of “rock n’ roll stars”, “the ones who are solving the big questions and transforming the world for the better.”

What are our ‘rock star’ alumni doing now?

Freddy had his PhD viva in May 2024, and has consequently founded his company Enstic. His team are designing and developing a range of simple and accessible machines, to help researchers easily describe and better understand insect populations in the field using their visual and sound patterns.

Kallista is now a Senior Analyst at Costello Medical, where she specialises in literature reviews and evidence synthesis. She leads efforts to accurately evaluate and synthesise scientific data, delivering high-quality, evidence-based insights that inform healthcare decision-making. Kallista also plays a key role in mentoring junior analysts, contributing to best practices and team growth.

Since completing her PhD, Alicia co-founded a biotech startup called BugBiome which focusses on developing bio-insecticides. One of their key innovations is the AvidX hardware platform designed for screening microbes to assess their pest protection capabilities.

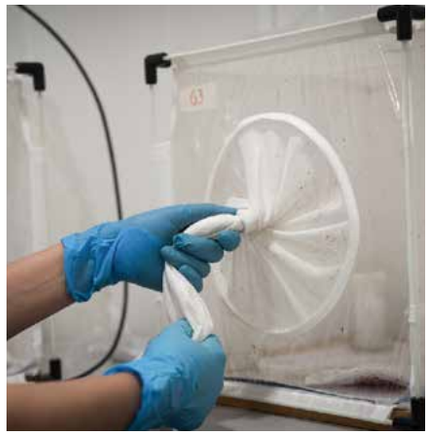
“I am lucky to have the opportunity to spend my time developing technology I believe will make a real-world impact for malaria prevention and pest control. I get to apply my scientific expertise in a practical and impactful way, working with a passionate team to bring our vision to reality!”

Dr Alicia Showering
Founder and CEO, BugBiome

London facilities

Malaria Reference Laboratory

The UK Health Security Agency (UKHSA) Malaria Reference Laboratory (MRL) is the national reference centre for malaria diagnosis in the UK and provides specialist diagnostics on malaria for NHS laboratories throughout the country. It is also the national centre for epidemiological monitoring and surveillance of malaria, conducts applied research relevant to UK malaria patients, and is an advisory service for complex questions on malaria. The MRL is currentlyassessing the potential risk to the UK of imported *P. falciparum* malaria with reduced susceptibility to the front-line antimalarial drug artemether-lumefantrine. Since 2015, the MRL have genetically and phenotypically characterised 45 UK cases of parasite recrudescence after treatment with this important drug combination. Genomic studies of these parasites, in collaboration with Malaria Centre researchers, are also ongoing.



Malaria Transmission Facility

An important target for novel interventions against malaria is the development of the parasite in the mosquito. With support from the Wellcome Trust, Malaria Centre members have established a transmission facility to promote the study of these stages of the parasite's life cycle, where infection of *Anopheles spp.* mosquitoes with human parasites are routinely carried out. This facility is open to collaborations across the wider malaria community, and has recently tested the effect of compounds targeting both parasite and mosquito with partners from across the UK, in Bangalore, India and from three different research teams in Australia.

Bioanalytical Facility

LSHTM's bio-analytical laboratory conducts analyses of the quality and level of antimalarial drugs, and measures the amount of insecticide on bed nets using chromatographic techniques. The lab can determine the quality of available drug formulations to combat the challenge of substandard, degraded, and falsified (including counterfeit) drugs found in malaria-burdened countries. Malaria Centre members use high performance liquid chromatography coupled with a photodiode array detector to quantitate many widely used antimalarials, and to analyse a range of insecticides on multiple media. The team has also developed non-laboratory-based screening methods for use in the field, to assess ACT quality and to chemically analyse levels of type 2 pyrethroids on bed nets.

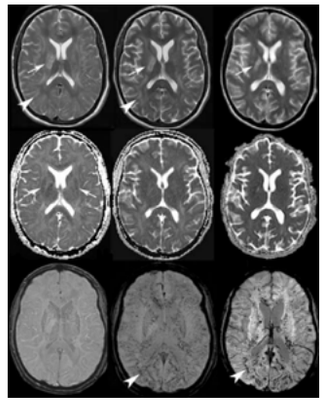
Poor-quality medicines pose a profound public health risk, contributing to increased morbidity, mortality, and antimicrobial resistance. Complex pharmaceutical supply chains, particularly in low- and middle-income countries, can exacerbate inequities in access to quality-assured medicines. There are numerous opportunities for substandard and falsified drugs to enter the supply chain, ultimately landing in the hands of patients who rely on effective medicines to protect and heal them. Recent research at the bioanalytical facility investigated innovative pharmacy supply chains and compared quality of commonly used antimalarials in Zambia. Fortunately, no falsified medicines were detected in the samples analysed during this study period. However, counterfeit and substandard medicines remain a pervasive problem in many LMICs which must be monitored closely.

Hospital for Tropical Diseases

The Hospital for Tropical Diseases is part of the University College London Hospitals NHS Foundation Trust (UCLH), and provides a walk-in service for the diagnosis of malaria for those recently returned from the Tropics. Diagnosis and treatment of malaria is free for all, wherever they come from, since malaria in the UK is a notifiable disease. As well as out-patient and travel-health sections, there is an in-patient ward at UCLH for the treatment of severe malaria and other tropical diseases.

In collaboration with HTD clinicians, LSHTM researchers have recently leveraged the access to neuroimaging facilities at UCLH to investigate brain changes in returning travellers with cerebral malaria, and compare findings with patients from India in the first temporal analysis of its kind. The long-term follow-up of patients in the UK highlighted long-lasting neurocognitive sequelae in adults.

Scan to find out more about our facilities



Facilities at Medical Research Council Unit The Gambia

The MRC Unit The Gambia at LSHTM (MRCG) hosts three insectaries, a molecular lab, a parasitology lab, and genomic and serology platforms. In addition to leading a range of research areas, the Unit offers malaria microscopy training, hosts regional workshops and supports PhD and MSc students, training the next generation of malaria scientists.

Genomic Surveillance Hub

The MRCG is a regional leader in genomic surveillance, with a range of projects committed to supporting National Malaria Control Programme decision-making and building regional capacity in bioinformatics, genomics, genomic data management and biobanking, while promoting data sharing. The MRCG contributes to the Genomic Surveillance of Malaria (GSM) in West Africa project, which includes facilities in seven countries working closely with national malaria control programmes and national public health labs to survey malaria parasite and vector resistance trends. In the Gambia, the GSM has established routine surveillance of clinical infections of malaria across 23 health facilities accompanied by annual surveys of *Anopheles* vectors in every region. So far, over 3,000 *Plasmodium falciparum* parasites and 2,000 vectors have been sequenced. With collaborators, the GSM is also strengthening capacity for spatial and temporal genomic analysis, training four early postdoctoral fellows and three bio-informaticians in deep amplicon sequencing and data analysis, in addition to supporting MSc students from LSHTM. The Unit is also part of the Pan-Africa Network for genomic surveillance of poverty-related diseases, leveraging genomic epidemiology to better understand disease aetiology, transmission dynamics, and the evolution of drug-resistant pathogens. Researchers at the Unit are particularly focused on molecular surveillance of *Plasmodium vivax* in Mauritania and *Plasmodium falciparum* in Guinea Bissau.

New Insectary

In March 2023, The MRCG officially inaugurated its new state-of-the-art insectary facility in Fajara, marking a significant milestone in the fight against insect–borne diseases, including malaria in Africa. The inauguration of the new facility signifies a significant leap forward in MRCG's collective efforts to combat malaria in Africa. It is expected to open doors to new research opportunities, attract funding for testing novel drugs and insecticides, and bring us closer to the goal of malaria elimination. This marks the third insectary for the MRCG, located strategically at sites in Wali Kunda, Basse and now Fajara.

Scan to find out more about our facilities

Parasite

Monitoring markers of diagnostic evasion

Efforts to control malaria are undermined by the emergence of two major biological threats posed by malaria parasites. First, there is the challenge of parasites escaping detection by widely used *hrp2*-based rapid diagnostic tests, due to deletions in the *hrp2* and *hrp3* genes. Second, these parasites are exhibiting partial resistance to artemisinin therapy, driven by mutations in the *pfk13* gene. The confluence of these two factors—diagnostic evasion and drug resistance—creates a dangerous synergy that allows the parasites to bypass both detection and therapeutic intervention.

Through collaborative research, LSHTM and partners have developed a robust molecular tool capable of detecting *hrp2/3* deletions in malaria parasites. This tool has been instrumental in conducting surveillance across Somalia, Kenya, Tanzania, Yemen, Nigeria, and other African countries, as well as among travelers returning to the UK. This novel technology has allowed the identification of *hrp2/3*-deleted parasites in multiple African regions, thereby supporting WHO-sponsored surveillance activities. In close collaboration with the WHO, LSHTM are actively supporting national malaria programmes in Eritrea, Somalia, Sudan, and Yemen to detect and contain the dissemination of these biological threats, through the deployment of new technologies and advanced training in malaria genomics.

Diagnostic challenges and digital solutions

Rapid diagnosis and treatment for malaria can be the difference between life and death. The most common tools for malaria diagnosis are rapid diagnostic tests (RDTs), which are quick, affordable, and easy to use. Unfortunately, mutations in *hrp2/3* genes in *Plasmodium falciparum* parasites allow them to evade detection by common RDT types. New diagnostic tools are urgently needed to ensure malaria cases don't go undetected and untreated.

Digital diagnostics can combine the accuracy of molecular tools like PCR with point-of-care speed and have the potential for mobile connectivity and integration with digital health systems. Centre members at MRCG are working with global partners to develop and evaluate two new digital molecular diagnostic platforms for malaria, Lacewing and Dragonfly. In addition to technology development, researchers are evaluating implementation use cases with local health systems, engaging with communities, and exploring pathways for data integration.

AI approaches to genomic surveillance

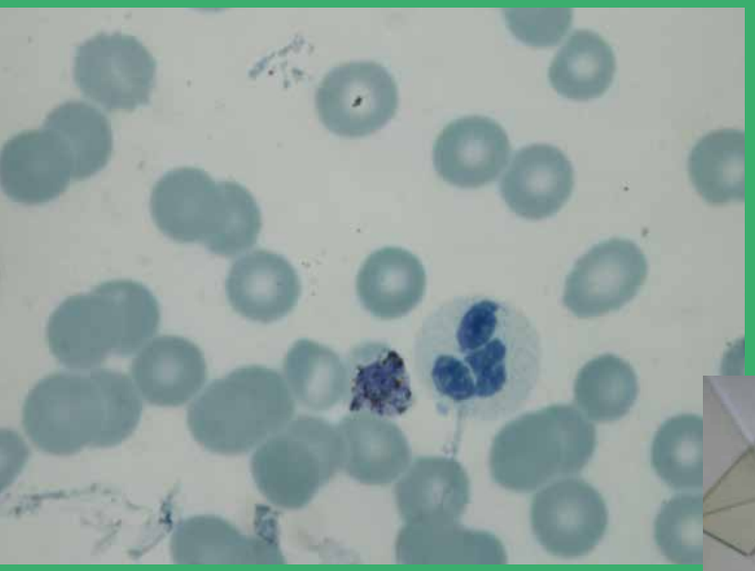
LSHTM researchers are using machine learning models and artificial intelligence to develop cutting-edge bioinformatic tools for genomic surveillance of malaria parasites.

The Malaria-Profiler tool can rapidly analyse both targeted and whole genome sequences of *Plasmodium* parasites. The pipeline searches for small variants (SNPs and indels) in genes associated with drug resistance and can predict the parasite species and its geographical origin.

Malaria-Profiler is a valuable tool for monitoring drug-resistance by detecting novel drug-resistant variants and changes in their frequency. This work is underpinned by extensive population genomics studies across various malaria species, including the sequencing of samples from travellers returning to the UK.

Collaboration with the Malaria Reference Laboratory (UKHSA) has demonstrated the utility of Malaria-Profiler for rapid profiling of cryptic Plasmodium samples from non-endemic regions. By integrating MinION technology for in-house nanopore sequencing, cryptic samples can be profiled within 24 hours, providing accurate information on drug resistance and geographical origin that aligns with travel history and clinical findings.

Future research and development efforts aim to incorporate advanced population genomic analysis and deep learning models to refine geographical classification, detect markers for rapid diagnostic tests, and expand the tool's application for broader malaria surveillance.



Front-line treatment failure risk found in UK malaria patients

Successful treatment of malaria caused by the parasite *Plasmodium falciparum* is reliant on a family of drugs called artemisinin-based combination therapies (ACT).
However, parasites with variants of the *pfk13* gene are now emerging in Africa. Variants of this gene previously found in Southeast Asia are associated with decreased susceptibility to the artemisinin component of ACTs. Recently, drug testing of parasites from UK travellers treated with the ACT artemether-lumefantrine (AL) also showed that lumefantrine efficacy is poor in some patients. This suggests that some parasites are at risk of developing resistance to AL.

Recent study findings indicate that a minority of the 40 African parasite lines adapted to laboratory culture since 2012 show some level of tolerance to lumefantrine in vitro. However, two of these, both from travellers visiting Uganda in 2022, were found to display very significantly reduced lumefantrine susceptibility. This finding has important public health implications, indicating the possible emergence of AL-tolerant *P. falciparum* in Africa. Centre members are engaged with collaborators across Africa, the US and Europe to unravel the mechanisms underlying these concerning observations. The medium-term goal is to identify a suitable molecular marker that can be used to track falling lumefantrine susceptibility which can be quickly deployed by surveillance teams in Africa.

Leveraging zoonotic *P. knowlesi* models to unravel *P. vivax* mechanisms and inform vaccine development

Malaria is caused by a range of parasites, with *P. falciparum* causing the majority of cases in Africa, while *P. vivax* is predominant across Asia and South America. As *Plasmodium vivax* cannot be cultured within the laboratory, researchers at LSHTM have developed a culture system for the closely related zoonotic malaria parasite *Plasmodium knowlesi*, which is an emerging cause of human infections in Southeast Asia.

P. knowlesi is amenable to genetic modification in the lab and particularly useful for studying how malaria parasites can invade red blood cells, as the invasive stages (merozoites) are double the size of *P. falciparum*. Malaria Centre researchers have adapted CRISPR-Cas9 genome-editing to this parasite and combined this with live-cell microscopy to study the role of key invasion genes.

This revealed distinct and sequential roles for two families of invasive proteins required for recognition and deformation of red blood cells. They also demonstrated that merozoites undergo movement called gliding motility, which may help selecting the “best” red blood cell to invade. By swapping in genes encoding *P. vivax* invasion proteins, they also used the resultant parasites to test and optimise new vaccines against *P. vivax* - supporting the first Phase I/IIa trials of Duffy-binding protein (PvDBP-RII) based vaccines. This model continues to inform P. vivax vaccine development through the OptiViVax Consortium.

Ongoing work will examine the roles of hundreds of genes associated with cell invasion, as well as establishing a way of studying mosquito transmission of *P. knowlesi* in the lab.

Scan to find out more about our projects

Mosquito

Evidence for the efficacy and durability of next-generation nets

Malaria Centre members and collaborators have undertaken a series of bed net trials over the past six years to generate crucial evidence for next-generation bed nets for the control of malaria. Next-generation nets have been created to combat resistance of mosquito vectors to pyrethroids, which was previously the only insecticide used on nets. Large cluster randomised control trials took place in Tanzania and Benin over a total of six years- and showed that chlorfenapyr-pyrethroid nets were nearly 50% more effective at reducing malaria incidence than standard pyrethroid nets. These nets have now received a WHO recommendation and are being rolled out across sub-Saharan Africa.

Alongside the trials, researchers also evaluated the durability of the nets- which are supposed to last for 3 years of use. The results in both settings showed that the next-generation nets had a survivorship of approximately 2 years and that there was a substantial reduction in the insecticidal efficacy and chemical content of dual-active ingredient nets in the third year after distribution.

Ongoing work by Centre members and collaborators includes the first epidemiological trial of PBO-pyrethroid nets in West Africa, with results available at the end of 2024, as well as experimental hut work in Benin and Cote d'Ivoire assessing the entomological impact of combining next-generation nets with different products of Indoor Residual Spraying (IRS).

Genomic surveillance shines a lens on insecticide resistance

At the MRCG, researchers are using genomic surveillance to uncover emerging insecticide resistance and characterise novel resistance mechanisms. Using whole-genome sequencing, Centre members investigated markers of insecticide resistance in Anopheles arabiensis mosquitoes. This species had previously shown no indications of resistance in this setting, but in coastal populations of the Gambia, high frequencies of L995S and L99DF mutations were observed, which confer resistance to pyrethroids and DDT. Copy number variations in Cytochrome P450 genes associated with metabolic resistance were also observed.

Researchers noted recent selection in a carboxylesterase gene cluster (coeae), not previously seen in malaria-transmitting mosquito species. The findings of this study reveal that coastal *An. arabiensis* populations in The Gambia are hotspots for insecticide resistance, and tailored interventions may be needed in these coastal areas.

Researchers at the MRCG and LSHTM are also exploring the utility of high-throughput genotypic screening using amplicon sequencing to monitor multiple insecticide resistance mechanisms in *Anopheles gambiae*. They performed amplicon sequencing targeting eleven known resistance markers using larval samples from nine entomological surveillance sites across The Gambia. This approach revealed eight resistance-associated single nucleotide polymorphisms (SNPs) present in the sampled populations, including the novel coeae1d mutation. Multiple resistance mechanisms were common, with 31.6% of samples having at least two resistance loci. The findings underscore the complexity of insecticide resistance in *Anopheles gambiae s.l.* populations, calling for a tailored and adaptive approach to vector control.

Similar work was conducted by LSHTM reseachers in the Bijagós Islands, utilizing amplicon sequencing to detect mutations linked to insecticide resistance in *Anopheles* mosquitoes. The prevalence of known mutations was found to be low. However, the detection of the vgsc L995F and N1570Y mutations, associated with pyrethroid resistance, highlights the need for ongoing monitoring. This is especially critical since pyrethroid-treated insecticide nets are the primary method of malaria control on the islands.

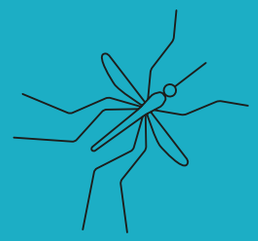
Other Centre members are using amplicon sequencing and whole genome sequencing to characterise vector population dynamics and monitor and explore resistance markers. This work provides insights into the geographical spread of insecticide resistance, and aims to identify more accurate markers for future large-scale use. *Anopheles stephensi* is an invasive vector that is posing a threat to malaria control in sub-Saharan Africa. High-throughput amplicon sequencing was applied in a recent study of invasive *An. stephensi* vector samples in Ethiopia, which confirmed presence of mutations in kdr and GABA genes associated with insecticide resistance. Genetic analysis of the its2 and cox1 genes showed Ethiopian samples shared haplotypes with samples of Pakistani origin, but also with samples from neighbouring Sudan and Djibouti, evidencing the spread of *An. stephensi* across the Horn of Africa.

These projects affirm that high-throughput screening with amplicon sequencing provides comprehensive insights into the molecular basis of insecticide resistance and can be a useful tool for refining vector control strategies. Consistent surveillance is crucial for programmes to adapt interventions to address quickly changing resistance landscapes.

Ivermectin mass drug administration: exploring alternative routes to mosquito control

With increasing insecticide resistance, novel approaches are required to reduce mosquito populations. Ivermectin is a widely available safe antiparasitic drug with mosquitocidal activity that is being explored for use in malaria control. Through the MATAMAL project, Malaria Centre members evaluated the effectiveness the combination of ivermectin (IVM) and Dihydroartemisinin-Piperaquine (DP) to reduce malaria transmission in the Bijagós Islands of Guinea-Bissau. IVM acts by killing mosquitoes that feed upon people who have taken the drug, whilst DP kills malaria parasites within the human.

They undertook a cluster-randomised placebo-controlled trial to assess the additive effect of IVM in combination with DP as mass drug administration (MDA) given to entire communities. Despite good coverage, tolerability and adherence to the interventions, adding IVM to DP MDA had no additional effect on reducing malaria transmission compared to DP MDA alone. Between intervention arms there was no difference observed in malaria prevalence or incidence, vector survival or vector density. Further research will contribute to understanding why IVM did not have the anticipated effect. This trial provides important context to other IVM evaluation trials in progress, future studies considering the use of IVM or other endectocides in combination with other malaria control interventions, and policymakers considering ivermectin for programmatic use.



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Life-long benefits of childhood malaria prevention

Limited studies have assessed the long-term impacts of malaria prevention in early childhood. The Ifakara Millennium Cohort Study began recruiting children born in rural Tanzania in 1998-2000. In 2019, a follow-up on this cohort successfully matched data for over 5,000 participants. Prior to this study, the longest published follow-up period for evaluating bed net use and long-term health outcomes was 7.5 years. The size and longevity of this ongoing study allow insights into the long-term effects of malaria control in early childhood on survival, health, education attainment, social outcomes and more in young adults.

In this 22-year cohort, the use of insecticide-treated bed nets in early childhood was associated with higher educational attainment and survival benefits persisting into adulthood. LSHTM researchers and collaborators found that each 10-percentage-point increase in early-life use of treated nets was associated with a 10% lower risk of death during the evaluation period. Higher use of treated nets was also associated with 47% higher odds of attaining 11 or more years of education, controlling for confounders including wealth, education level of caregivers and year of birth.

Cohorts of this size and duration are rare and valuable research assets for characterising long-term health effects of early-life interventions.

Environment

In sub-Saharan Africa, malaria has historically been considered a disease mainly affecting people living in rural areas. The transmission patterns are influenced by a range of factors including vector biology, socioeconomic disparity, land use and cover, and urban planning. Rapid population growth and expansion of cities combined with human and vector migration pose new challenges for urban malaria control.

Climate change and malaria – what do we know?

LSHTM researchers joined the WHO's Task Team on Climate Change, neglected tropical diseases (NTDs), and Malaria to conduct a scoping review of how climate impacts these diseases, examining 1,543 full-text papers out of 42,693 initially identified records. Among the selected papers, malaria was the most studied disease (36% of papers), while some NTDs were notably underrepresented. The majority of papers (85%) used modelling to study the effects of climate change, whilst only 34% addressed mitigation strategies, and just 5% focused on adaptation.

Extreme weather events and their effects on malaria transmission are already being acutely felt. Severe flooding in Pakistan in 2022 and cyclones in Mozambique and Madagascar in 2023 were accompanied by local spikes in malaria cases, driven by breeding of *Anopheles* mosquitos in flood waters and disruption of routine health services.

Global warming could extend the suitable range for malaria transmission into new geographies, while making conditions in some currently endemic areas too severe for transmission. Though a greater proportion of the global population may become at risk, the potential net impact of climate change on malaria burden remains unclear. This is further complicated by the secondary impacts of climate change, including conflict and migration. Comprehensive, collaborative and standardised modelling efforts are needed to better understand how climate change will directly and indirectly affect malaria and NTDs.

The effects of climate change and associated changes in malaria and NTD transmission intensity will likely be felt most acutely by populations who have contributed the least to the climate crisis. Further study is needed to quantify risks and to equip vulnerable countries and populations with tools to navigate this growing challenge.

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Invasive species driving urban malaria outbreak

Anopheles stephensi is a malaria-transmitting mosquito species native to South Asia and the Arabian peninsula. In the last decade it has migrated to sub-Saharan Africa (SSA), first in the horn of Africa but more recently also Ghana and Nigeria. This species has several characteristics that could change current transmission patterns in sub-Saharan Africa. These include ability to exploit both animal and human hosts, tendency to rest both in- and outdoors, tolerance to more extreme temperatures, and propensity to breed in man-made habitats and containers such as water tanks. Large regions of SSA are undergoing rapid urbanisation, creating environments likely to facilitate the spread of *An. stephensi*. As malaria transmission occurs predominantly in rural areas, this could potentially result in outbreaks in immunologically naïve populations.

Malaria Centre researchers and collaborators recently investigated the role of *An. stephensi* in an urban malaria outbreak in Dire Dawa, Ethiopia. They found strong associations between spatial clustering of *Plasmodium falciparum* infections and the presence of *An. stephensi* in the household. Plasmodium sporozoites were also detected in *An. stephensi* mosquitoes. Additionally, one quarter of all microscopy-positive infections were negative by PfHRP2-based rapid diagnostic tests.

The parasite population responsible for this outbreak showed high prevalence of mutations in the kelch13 and pfhrp2/pfhrp3 genes. This concurrence supports a plausible role for *An. stephensi* in driving an outbreak of *P. falciparum* infections, with parasites carrying markers of diagnostic and drug resistance.

Molecular approaches to mosquito surveillance using environmental DNA

LSHTM researchers, including the Resilience Against Future Threats to Vector Control (RAFT) Consortium, are working on a range of projects to address the growing threat of urban malaria and the invasive *An. stephensi* species. This includes compiling insights on *An. stephensi* control from Asia, developing novel approaches to species and insecticide surveillance, and understanding the acceptability and efficacy of housing modifications for malaria control.

Genomic epidemiologists and entomologists at LSHTM have teamed up to explore the possible use of environmental DNA (eDNA) surveillance to detect invasive mosquito species and assess insecticide resistance markers. Phase I of this study found that eDNA is suitable for simultaneous detection of *An. stephensi* and *Ae. aegypti* in laboratory conditions. Novel amplicon-sequencing panels were developed for both vector species which could feasibly characterise insecticide resistance mechanisms from eDNA shed at relatively low concentrations of larvae in water. Phase II of the eDNA project conducted in Ghana confirmed feasibility of eDNA collection in real-world field conditions, and the findings of this study will be disseminated to key stakeholders. This methodology could be implemented in local endemic communities and points of country entry to strengthen vector surveillance.

Housing modifications as a malaria prevention tool

As population sizes increase, so does the need for housing. This brings opportunities to build houses that help to reduce the spread of vector-borne diseases. Centre members and collaborators are investigating the efficacy and acceptability of housing modifications to reduce exposure to malaria.

Malaria control efforts in high-burden countries like Uganda have hit a standstill due to increasing insecticide and drug resistance, making current methods less effective. Recent research suggests that simple housing modifications might offer a sustainable and cost-effective solution. Two promising interventions are screening and eave tubes. Eave tubes are small devices with insecticide-coated mesh that are installed in the walls of homes to block and kill mosquitoes.

Alongside the Uganda Housing Modification Study, a cluster randomised control trial in eastern Uganda explored the costs and willingness of households to pay for these modifications.

The trial team modified around 4,000 homes, comparing the interventions to a control group. It found that screening (windows, ventilation openings) costs $116 per house, while eave tubes cost $50. Wealthier households faced higher costs for both interventions compared to poorer households.

However, willingness to pay was much lower, with households ready to cover only a fraction of the costs—$9.39 for screening and $8.27 for eave tubes. Wealthier households were more willing to contribute, but only a small percentage of all households were willing to pay the full amount.

These findings highlight a significant funding gap for these kinds of interventions, particularly in poorer homes. While housing modifications can be a valuable addition to malaria prevention, substantial financial support will be needed to make them widely accessible.

The consequences and drivers of large between-cluster heterogeneity in malaria cluster randomised trials

Malaria transmission is highly sensitive to a range of climatic and environmental factors, even at very fine scales. It is important to account for this spatial variation when deciding where to target interventions, and to account for expected levels of variation in study design.

Cluster randomised trials (CRTs) are vital for evaluating the impact of malaria interventions and they can provide evidence for policy recommendations. When designing CRTs, triallists must account for the between-cluster variability (or coefficient of variation (k)) in outcomes to ensure there is sufficient power to detect statistically significant effects of intervention(s).

The value of k heavily impacts the size of trials and is typically estimated without prior knowledge by investigators.

Together with collaborators, Centre members conducted a systematic review and meta-analysis of malaria CRTs to determine the consequences and drivers of between-cluster heterogeneity. Using cluster-level data from 21 trials, the data showed that between-cluster heterogeneity was typically larger than anticipated at the design stage, which resulted in lower study power and led to increased uncertainty around effect size estimates.

Large between-cluster heterogeneity was found to be more pronounced in lower endemicity settings and during wet seasons. Heterogeneity was greater between cluster-level incidence outcomes, compared to prevalence. Additionally, uneven intervention coverage was associated with greater heterogeneity between cluster-level prevalence outcomes. These results will inform future trial design and help ensure vital malaria interventions are adequately evaluated.

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Human

Introducing new malaria vaccines and optimising deployment

In the last four years, two ground-breaking pre-erythrocytic malaria vaccines have been approved by the WHO for use in children under five years old. Malaria Centre members have had leading roles in the evaluation of these vaccine candidates, and continue to be involved in optimising vaccine implementation. LSHTM researchers supported the mass RTS,S/AS01 Malaria Vaccine Implementation Programme, trialed RTS,S/AS01 in combination with Seasonal Malaria Chemoprevention, analysed data from the phase 3 trial of R21/Matrix-M and presented it to the WHO and country level regulatory authorities, leading to approval of the vaccine in October 2023. LSHTM researchers contribute to WHO policy recommendations and support national malaria control programmes to make data-driven decisions for vaccine implementation.

Centre members are also working on phase 2 trials of the blood-stage vaccine RH5 which have shown promising results on efficacy. They will continue to be involved in trials that are commencing soon on how the RH5 vaccine works in combination with pre-erythrocytic vaccines. Centre members are continuing further research into optimisation of vaccine implementation. Researchers at the MRCG recently began a multi-centre cluster-randomised controlled trial to determine the impact of seasonal R21/Matrix-M vaccination given to people of all ages on malaria morbidity and transmission. All study villages continue to receive standard control interventions (e.g. seasonal malaria chemoprevention and insecticide-treated bed nets), with villages randomised to the intervention arm receiving a 3-dose series over 3 months prior to malaria transmission season, followed by a booster dose 12 months after the final dose.

Cross-sectional surveys, monthly blood samples, and passive case detection will be used to assess malaria prevalence and incidence. The results of this study will determine whether mass vaccination with R21 can reduce transmission countries with different intensity of transmission.

The two approved malaria vaccines are not a silver-bullet. The WHO currently recommends using vaccines in addition to a suite of other malaria interventions including vector control tools and chemoprophylaxis. The optimal combination of interventions can vary with local epidemiology, and the relative benefits of intervention combinations are being explored. LSHTM researchers are working with partners to assess the combined effect of the RTS,S/AS01 vaccine with perennial malaria chemoprevention (PMC), the administration of preventative anti-malarials to children under 5 throughout the year.

This double-blind, placebo-controlled study will assess the efficacy and safety of combining the vaccine with sulphadoxine-pyrimethamine (SP) or SP plus amodiaquine (SPAQ) PMC drugs. It will also evaluate the impact on immune responses. Alongside the trial, the study will assess the feasibility and acceptability of combined intervention among health care staff and parents of study participants. The findings of this study will inform policy and implementation of combined interventions.

Antimalarials can stop the symptoms, but do they stop onward transmission?

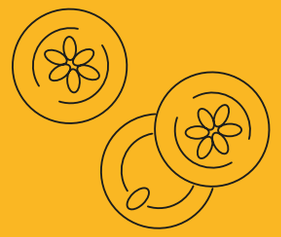
Artemisinin-combination therapies (ACTs) are highly effective at eliminating the blood stage parasites causing malaria symptoms. However, ACTs have limited activity against gametocytes, the only parasite stages able to infect mosquitoes. Unhindered, these gametocytes may allow continued malaria transmission within communities and facilitate the spread of drug resistance.

Triple artemisinin-combination therapies (TACTs) are intended to counter the growing threat of artemisinin partial resistance, but their effect on transmission blocking was unknown. A single low-dose of primaquine is known to block transmission quickly, but its added benefit to TACT and other commonly used treatments and chemoprevention drugs (ACT-artesunate amodiaquine and SPAQ) was unclear. Together with scientists in Mali and the Netherlands, researchers at LSHTM investigated the effect of ACT, TACT, and SPAQ regimens, alone or in combination with a single dose primaquine or tafenoquine (another primaquine-like drug) on human-to-mosquito transmission.

Trial participants were randomised into the different treatment groups, after which blood samples from these participants were fed to mosquitoes to evaluate human-to-mosquito transmission.

They found that the addition of a single, low dose of primaquine to any of the observed antimalarial regimens effectively blocked transmission to mosquitos within 48 hours. They also found that artemether-lumefantrine was effective in blocking transmission alone, but ASAQ was less effective and SPAQ had little to no transmission-blocking effects without the addition of primaquine or tafenoquine.

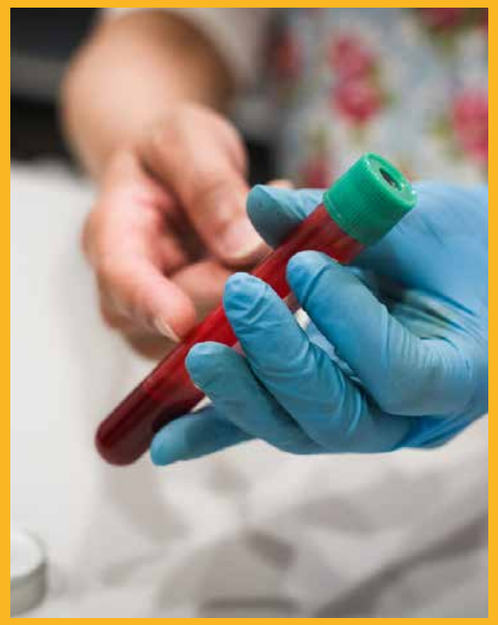
These results support the suggestion from the WHO malaria policy and advisory group to add a single low dose of transmission-blocking primaquine to antimalarial therapy in areas where partial artemisinin resistance has been detected and prompts further investigation of benefits of adding primaquine to SMC regimens.



Impact of zoonotic malaria on brain and vascular health

Plasmodium knowlesi is a malaria parasite originally known to infect primates, particularly long-tailed and pig-tailed macaques in Southeast Asia. It can infect humans, causing a severe form of malaria, and its emergence in Malaysia has led to a surge in zoonotic malaria cases and deaths in recent years. Signs of cerebral involvement have been observed in a non-comatose, fatal case of severe *P. knowlesi* infection, but the potential impact of this malaria species on the brain remains unexplored.

As part of this project, researchers investigated circulating levels of brain injury, inflammation, and vascular biomarkers in a cohort of *knowlesi*-infected patients and controls. They uncovered compelling evidence suggesting a significant impact of *P. knowlesi* infection on brain and vascular health.



The identification of distinct patterns in the clustering of biomarkers associated with cerebral injury and endothelial dysfunction highlights the complex interplay between these pathways during infection with *P. knowlesi*.

This study lays the groundwork for further research to elucidate the pathophysiology of this disease, and its potential long-term effects on the brain. Additional investigations are ongoing to assess structural and functional changes in the brain during *knowlesi* malaria, through both neuroimaging and longitudinal neurocognitive evaluations. These findings may have future implications for the diagnosis, management, and therapeutic approaches of this emerging infectious disease.

Yewterreh! Engaging communities in malaria research using forum theatre

The Yewterreh for Malaria! Project, based in The Gambia, communicated key outcomes and engaged villages participating in a malaria transmission study (INDIE) through forum theatre combined with the local art of Kanyalang dance and drum. Forum theatre is a participatory activity, where audience members join the performance by replacing actors to re-enact different sketches, changing characters' actions to improve the outcome of the scene. (i.e. using a bed net properly to prevent mosquito bites).

Yewterreh in the Fula language translates to "let's discuss/come together". Each event opened with Kanyalang performances, followed by a presentation of findings from the INDIE project in local languages (Fula and Mandinka). Forum theatre sketches were then used to portray and discuss participation in scientific research, usage of insecticide-treated bed nets, and uptake of malaria chemoprevention. These sketches were performed by a local theatre group and involved extensive audience participation.

Post-performance surveys showed increased understanding of the project aims and outcomes among participants, as well as increased understanding of how to protect themselves and their children from malaria - particularly through proper use of bed nets. Feedback showed a positive attitude towards collaboration with the MRCG, especially where projects provide access to free health provisions in communities which normally have difficulty accessing care.

These results reaffirm the importance and benefit of including community voices throughout the study design process. It is also essential to embed locally tailored plans for dissemination of findings to affected communities and to prioritise public engagement activities to foster sustainable partnerships with study communities.

Monitoring and upscaling chemoprevention interventions

Malaria chemoprevention is a safe and effective malaria control tool which involves administration of antimalarial drugs, most commonly sulphadoxine-pyremethamine (SP), to vulnerable populations at strategic timepoints to prevent malaria infection. In 2022, the WHO updated recommendations for use of seasonal malaria chemoprevention (SMC), perennial malaria chemoprevention (PMC), and intermittent preventative treatment of malaria in pregnancy (IPTp), and added three new forms: IPT in school children (IPTsc), post-discharge malaria chemoprevention (PDMC), and Mass Drug Administration (MDA). Malaria Centre members are involved in research across these chemoprevention strategies, including several ongoing implementation research projects.

Centre members are monitoring efficacy of chemoprevention tools against multiple indicators of protection and burden reduction and exploring the potential protective effects of expanding the age-range and timing of interventions. Work also includes assessment of delivery models for equity, acceptability and feasibility, while identifying barriers to uptake and strategies to overcome them. Cost-effectiveness and combined impact with other malaria interventions are under consideration, as is drug suitability.

Parasite resistance to SP is a significant concern for chemoprevention programmes, so surveillance of drug resistance markers and the impact those resistance markers have on SP's ability to prevent infection are high priorities. LSHTM researchers and collaborators are analysing retrospective and live developments in SP resistance in *Plasmodium falciparum* parasites, testing the impacts of drug resistance mutations on SP efficacy and have developed a model for improved surveillance frameworks and trial design.

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Policy development and implementation research

LSHTM malaria research is used to inform policy and provide guidelines for implementation.

We work closely with international policy-makers, implementers and government bodies, including the World Health Organization and National Malaria Programmes. LSHTM is represented on all four standing Global Malaria Programme Advisory boards: the Malaria Policy Advisory Group, the Vector Control Advisory Group, the Technical Advisory Group on Malaria Elimination and Certification, and the Malaria Vaccine Advisory Committee.

Malaria Centre members contribute to WHO and national policies in several ways.

Our research informs WHO guidelines for implementation of new tools, and influences target product profiles and preferred product characteristics for new developments. Our members participate in technical consultations and taskforces for the Global Malaria Program and regional bodies. Our data is included in the World Malaria Report and is used to inform national malaria strategies.

Centre members also sit on funding boards and technical review panels including EDCTP and UKRI.

New Nets Project

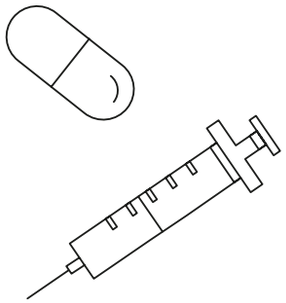
Through the New Nets Project, LSHTM helped to build the evidence needed to inform the WHO's 2023 policy recommendation for use of dual-active (dual-AI) ingredient insecticide treated nets in areas where mosquitoes are resistant to pyrethroids. Over 50 million live-saving dual-AI nets have been distributed to protect children and their families against malaria and combat the threat of insecticide resistance. Active surveillance of insecticide resistance markers and ongoing work on combining dual-AI nets with other interventions will continue to help countries strategically deploy these tools for maximum impact.

Malaria Vaccine Implementation Programme

LSHTM research informed WHO assessments of two recently approved malaria vaccines. The Malaria Vaccine Implementation Programme paved the way for the ongoing roll-out of RTS,S/AS01, followed by R21/Matrix-M. Over 4 million doses have been delivered to 10 countries so far. As countries begin to introduce these vaccines, Centre members and collaborators are conducting implementation research to support countries to optimise the use of vaccines to improve the lives of millions.

Perennial Malaria Chemoprevention

Malaria chemoprevention is an effective but underused intervention in many areas. In 2022, the WHO expanded its recommendations for use of Perennial Malaria Chemoprevention (PMC) for averting severe malaria in children under 5 years old. Through the Plus Project, LSHTM researchers and collaborators are conducting a range of research to inform national decision-making, including economic evaluation, drug suitability, and policy adoption. Working closely with national malaria programmes to develop country-adapted models of PMC, this implementation research will help countries decide if and how to use PMC in their malaria control strategies.



PhD students

PhD students and early career researchers are a vital part of the Malaria Centre. They represent the future of malaria research, bringing new approaches and enthusiasm to drive innovation. Many of our students are based in London, but nearly half are based in other countries around the world. Their projects cover a breadth of topics from parasite invasion mechanisms to large cluster randomised trials.

Can you briefly describe your research focus?

My research is focused on the social determinants of perennial malaria chemoprevention uptake and impact in Cameroon and Cote d'Ivoire.

What has been your favourite part of your PhD so far?

"So far, my favorite aspects of the research have been working with our partners in Cameroon and Côte d'Ivoire. The teams in both countries were incredibly kind and welcoming and helped me develop a more nuanced understanding of the context. Being involved in the fieldwork and seeing the data collection firsthand has also been invaluable in understanding the data."

What are some of the biggest challenges you are facing, and how do you overcome them?

One challenge I've found is that in a PhD you are individually responsible for your research. The freedom to make choices can be enjoyable at times but can also be daunting and make you doubt yourself. In those moments it's been very helpful to have the support of other PhD students who are feeling or have felt the same way, and academics at LSHTM who can help guide me through the next steps.

What made you interested in pursuing this particular PhD project?

I'm interested in social determinants of health because I think without them we can only answer part of the most important questions. Understanding the facets of non-medical factors, and the pathways and interactions between them, allows us to determine who and where we can help the most.

Jonna Messina Mosoff
PhD student

Can you briefly describe your research focus?

My research employs the principles of population genetics and genomics to understand how the neglected malaria parasites, *P. vivax* and *P. ovale* evolve resistance to frontline antimalarial drugs.

What motivated you to pursue a PhD in your field?

Malaria biology has always fascinated me. Unfortunately, I am awful at bench science, so a project that focuses on bioinformatics and molecular epidemiology of malaria felt like the perfect fit!

What are some of the biggest challenges you are facing, and how do you overcome them?

I'm based in the UK, so the lack of representation of Black women at various levels in academia can feel extremely isolating. However, networking events, conferences, collaboration, and seeing the work of the exceedingly talented women at the MRCG and other research institutions has made me feel more at home in academia.

How do you balance your PhD work with other aspects of your life?

I try to set firm boundaries, but when that fails, I have a truly fantastic support system to drag me away from my numerous R error codes on a late Friday afternoon!

Who are the most influential mentors or supporters in your PhD journey?

I have been mentored by and look up to lots of incredible researchers based at LSHTM and beyond. However, my biggest supporters will always be my parents, who instilled in me a love of learning from a very young age.

What advice would you give to someone considering pursuing a PhD?

"Some practical advice is 'don't let perfect be the enemy of good', but the best advice I've been told is to have fun! The time goes by so quickly."

What's next?

Going to conferences ignited my interest in healthcare policy. I'd like to pursue a career in this field initially but I'm very open to wherever life takes me!

Gabbie Ngwana-Joseph
PhD student

What was your PhD title?

'Towards malaria elimination: Innovative tools and interventions to accelerate interruption of malaria transmission in The Gambia'.

What were some of the biggest challenges you faced, and how did you overcome them?

Of course, the PhD journey came with some challenges. One of the biggest hurdles was time management—finding the delicate balance between family life, intensive fieldwork, and office responsibilities. At the same time, I was coordinating two large clinical trials. Balancing these responsibilities with my PhD was a constant struggle, as I had to learn new skills, analyse complex data, and write manuscripts, all while meeting the demands of my research projects.

Another major challenge was maintaining resilience and motivation through the inevitable setbacks, such as rejected manuscripts and long revision processes. Each time, I had to persist and stay focused on the bigger picture. These experiences, while difficult, ultimately made me a more determined and resourceful researcher.

What motivated you to pursue a PhD in your field?

"As a Research Clinician living in a malaria-endemic country, I am constantly confronted with the devastating impact of the disease in the communities."

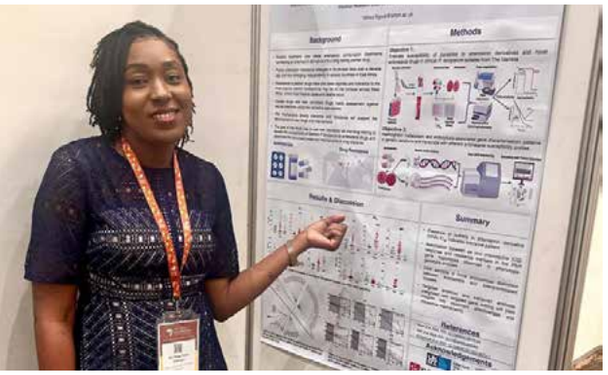
This created a deep personal and professional drive to support malaria elimination efforts by contributing to generating evidence-based strategies and impactful interventions. To make this end, it was important for me to pursue a PhD to deepen my research skills, contribute to scientific knowledge and develop innovative solutions tailored to the specific needs of communities.

What's next?

I have the exciting opportunity to start on a post-doctoral fellowship, where I will assess the impact of mass vaccination with the new malaria vaccine R21/Matrix within a community-based trial, using innovative high-resolution serological metrics. During this fellowship, I will deepen my expertise in serology, geospatial analysis, and modelling, while also expanding my international network of collaborators.

Achieving this fellowship will be a critical milestone in my career, positioning me to emerge as an independent researcher, which would be key for contributing significantly to reducing the malaria burden in sub-Saharan Africa through impactful, evidence-based interventions.

Edgard Dabira
Completed PhD 2023



Can you briefly describe your research focus?

My research focuses on investigating how variations in genetic determinants of resistance to chloroquine and other antimalarials influence responses to artemisinin-based combination therapies. By understanding these genetic factors, we can gain insights into the mechanisms of drug resistance, which is crucial for developing effective treatment strategies against malaria.

How do you think your research can impact the broader community or your field of study?

Understanding the complexities of malaria and how drug resistance develops empowers community members to make informed decisions about their health, including the importance of adhering to treatment protocols. Fostering an informed public strengthens participation in malaria control efforts, and ensures that research is conducted ethically and respectfully, maximizing its social value and relevance to those it aims to help.

What are some of the biggest challenges you are facing, and how do you overcome them?

"Balancing the demands of motherhood and caring for an elderly family member while pursuing my PhD has been one of my biggest challenges. It can be overwhelming at times, but I overcome these obstacles through the unwavering support of my colleagues, family, and friends."

What advice would you give to someone considering pursuing a PhD?

My advice would be to ensure you are passionate about your research topic, as this will keep you motivated through the ups and downs of a PhD journey. Additionally, don't hesitate to seek support from mentors, colleagues, and your personal network. Building a strong support system can make a significant difference.

Ndey Fatou Drammeh
PhD student

Can you briefly describe your research?

My PhD focusses on investigating understudied protein families in *Plasmodium falciparum* that are associated with disease pathology - specifically the STEVOR protein family.

Can you share a particularly memorable moment or breakthrough during your research?

One of my most memorable experiences was during my fieldwork on the Bijagos Islands in Guinea-Bissau, a four-hour ferry ride from Bissau.

"I spent three months there collecting dry blood spots while living in a tent in remote areas without cars, money, electricity, or running water. I learned to speak Portuguese Creole and became part of the local community. This experience taught me invaluable lessons about humanity, appreciating the small things, and being grateful for what we often take for granted every day."

Could you describe a bit of your academic and professional journey?

I completed an MSc in Medical Microbiology at LSHTM in 2017, then began working as a Scientific Officer on various projects and diseases under the guidance of my future supervisor, Anna Last. An opportunity arose to lead laboratory work for the MATAMAL project while based at MRCG, and I was fortunate to have the opportunity to pursue a PhD project in conjunction with that work. Four years and five months later, including one pandemic, working in three countries, completing a thesis, attending several conferences, and receiving a Director's Award, I successfully passed my Viva.

I am now a Research Fellow under Alfred Ngwa at the MRC Unit in The Gambia, continuing my work in malaria research by building on my immunology expertise and exploring new techniques in malaria genomics, both in the wet lab and in data analysis.

Hristina Vasileva
Completed PhD 2024

Thank You Professor Greenwood

We would like to offer a heartfelt congratulations to Malaria Centre Co-founder, Sir Brian Greenwood, on the occasion of his retirement.

After qualifying in medicine at Cambridge University in 1962 and completing his medical internships in London, Brian spent the next 15 years in Nigeria, first at University College Hospital, Ibadan and then at Ahmadu Bello University, Zaria where he helped to start a new medical school and developed his interests in malaria and meningitis.

In 1980, he moved to The Gambia where he directed the UK's Medical Research Council Laboratories for the next 15 years, supporting a broad-based programme of research on the prevention of the major infectious diseases prevalent in West African children, including malaria. In 1996, he moved to the London School of Hygiene & Tropical Medicine where he has maintained his research on the prevention of malaria, meningococcal and pneumococcal infections. In 1998, with Professor Eleanor Riley, he established the LSHTM's Malaria Centre.

Since 2014, he has supported the development of a new research centre in Kambia, Sierra Leone where trials of two Ebola virus vaccines have been undertaken.

From 2000 – 2008, he coordinated the Gates Malaria Partnership, and from 2008-2017 its successor programme, the Malaria Capacity Development Consortium, which have both supported over 50 African PhD and post-doctoral fellows to undertake research on various practical aspects of malaria control. This initiative is being continued through the MARCAD and MARCAD Plus programmes coordinated by Prof Gaye at the Cheikh Anta Diop University of Dakar.

What is the achievement you are most proud of?

Supporting in various ways the careers of African scientists who have gone on to make major contributions to control of malaria and other infections in their own countries.

"If malaria research is what you really want to do, it is worth taking this risk. If you do not do so this will be something that you will always regret."

What advice would you give an early career researcher in malaria?

If you want to follow a career in malaria, go for it even if people encourage you to follow a more conventional and secure career. This may involve some risk but if malaria research is what you really want to do, it is worth taking this risk. If you do not do so this will be something that you will always regret.

Where has been your favourite country to visit or work?

Nigeria where I worked and brought up my young family in the 1960s and 1970s was a rewarding and enjoyable country in which to live and work but my choice now has to go to The Gambia.

Looking back at your career, is there something you would NOT do again?

Agree to review so many papers and grant applications.

What is your most treasured possession?

A wooden carving of a traditional Nigerian doctor with his acolytes and medicine bags carved for me by a well-known Yoruba sculptor 60 years ago and subsequently always a great hit with my young children and grandchildren.

Collaborators

Australia
- Australian Defence Force Malaria and Infectious Disease Institute
- University of Sydney
- Walter and Eliza Hall Institute of Medical Research (WEHI)

Austria
- University of Health and Allied Sciences

Belgium
- Institute of Tropical Medicine Antwerp

Benin
- Centre de Researche de Entomologique Cotonou (CREC)
- Republique du Benin, Programme National de Lutte contre le Paludisme du Benin

Burkina Faso
- Burkina Faso, Programme National de Lutte contre le Paludisme
- Institut de Recherche en Sciences de la Sante (IRSS)
- Institut des Sciences et Techniques de Bobo

Brazil
- University of São Paulo Fiocruz: Fundação Oswaldo Cruz

Cambodia
- Health and Social Development Institut Pasteur
- National Centre of parasitology, entomology and malaria control (CNM)
- National Institute of Public Health

Cameroon
- Cameroon National Malaria Control Programme
- Centre for Research in Infectious Diseases (CRID)
- The Centre for Health Implementation and Translational Research at the Fobang Institutes & the LAPHER Biotech, University of Yaounde

Canada
- Ottawa Hospital Research Institute
- University of Ottawa

Cape Verde
- Instituto Nacionalde Saúde Pública (INSP)
- Jean Piaget University

Chad
- République du Tchad: Programme National de Lutte contre le Paludisme du Tchad

China
- Shanghai Jiao Tong University School of Medicine

Colombia
- Facultad de Medicina, Universidad de Antioquia

Côte d'Ivoire
- Africa Rice Center
- Centre Suisse de Recherches Scientifiques (CSRS)
- Institut National de Sante Publique (INSP)
- Institutet Pierre Richet
- Université Alassane Ouattara

Denmark
- University of Copenhagen
- Royal Danish Academy

DRC
- University of Kinshasa

Equatorial Guinea
- MCD Global Health, Malabo
- National Malaria Control Programme

Ethiopia
- Jimma University

France
- Institut Pasteur France-Paris
- Institut Cochin, Inserm U1016-CNRS
- MIVEGEC Laboratory

Gabon
- Centre International de Recherches Médicales de Franceville

Germany
- Centre for Structural Systems Biology (CSSB)

Ghana
- Ghana, National Malaria Control Programme
- Kintampo Health Research Centre
- University of Ghana
- Ghana Health Service

Guinea
- Centre Nationalde Formation de Recherche en Sante Rurale de Maferinyah
- République du Guinea, Programme National de Lutte contre le Paludisme
- Bandim Health Project (BHP)
- Instituto Nacional de Saude Publica (INASA)

Guinea Bissau
- Programa Nacionalde Lutacontra o Paludismo – PNLP
- Projecto de Saude Bandim

India
- Community Welfare Society Hospital
- Ispat General Hospital
- National Institute of Malaria Research

Japan
- Kanazawa University
- Nagasaki University

Kenya
- Kenya Medical Research Institute (KEMRI)

Latvia
- Latvian Organic Synthesis Institute

Mali
- University of Bamako
- Malaria Research and Training Centre (MRTC), University of Bamako
- République du Mali, Programme National de Lutte contre le Paludisme

Malaysia
- Univeristi Malaya

Mozambique
- Centrode Investigacao em Saude da Manhica (CISM)
- Faculty of Medicine Edulardo Mondlane University

Namibia
- Southern African Development Community Malaria Elimination Eight Secretariat

Netherlands
- Amesterdam University Medical Centre (AMC)
- Radboud University Medical Centre, Nijmegen
- HeathNet TPO

Niger
- République du Niger, Programme National de Lutte contre le Paludisme du Niger

Nigeria
- Federal Republic of Nigeria, National Malaria Elimination Programme
- International Institute of Tropical Agriculture
- Nigeria Institute of Medical Research (NIMR)

Peru
- Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas
- Universidad Peruana Cayetano Heredia

Philippines
- International Rice Research Institute

Saudi Arabia
- King Abdullah University of Science and Technology

Portugal
- Instituto de Higiene e Medicina Tropical de Lisboa

Senegal
- Cheikh Anta Diop University
- Institut de recherche pour le développement (IRD)
- République du Senegal, Programme National de Lutte contre le Paludisme
- University of Thiès, Senegal

Singapore
- Lee Kong Chian School of Medicine
- National University of Singapore

Somalia
- National Malaria Control Program

South Africa
- University of the Witwatersrand
- African Institute for Research in Infectious Diseases

Spain
- European Molecular Biology Laboratory in Barcelona
- Instituto de Salud Carlos III
- Barcelona Instutite for Global Health (ISGlobal)

Sudan
- Omdurman Islamic University

Switzerland
- Bern Inselspital
- Medicines for Malaria Venture (MMV), Switzerland
- Swiss Tropical and Public Health Institute
- UNDP/UNICEF/World Bank/WHO Special Program for Research and Training in Tropical Diseases (TDR)
- University of Basel
- University of Geneva

Tanzania
- Ifakara Health Institute
- Kilimanjaro Christian Medical College (KCMC)
- National Institute of Medical Research (NIMR)
- Kilimanjaro Christian Medical University College (KCMUCo)
- Pan-African Malaria Vector Research Consortium
- Pan African Mosquito Control Association

Thailand
- MORU Bangkok
- Mahidol University

The Gambia
- MRC Unit The Gambia at LSHTM
- Republic of The Gambia, National Malaria Control Programme

Togo
- République du Togo, Programme National de Lutte contre le Paludisme

Uganda
- Infectious Diseases Research Collaboration, Kampala
- Makerere University
- Ministry of Health

UK
- Aberystwyth University
- Durham University
- Imperial College London
- Innovative Vector Control Consortium (IVCC)
- University College London
- Liverpool School of Tropical Medicine
- Malaria Consortium
- St Georges University
- University of Cambridge
- University of Cardiff
- University of Dundee
- University of Glasgow
- University of Nottingham
- University of Oxford, Jenner Institute

USA
- CDC USA
- Johns Hopkins University
- MCD Global Health, Maryland
- National Institute of Allergy and Infectious Diseases (NIAID)
- New York University
- Penn State University
- PMI Insights
- Program for Appropriate Technology in Health (PATH)
- Save the Children International
- Seattle Children's Hospital
- Stanford University
- University of California, Irvine
- University of California, San Francisco
- University of Maryland
- University of Nevada Las Vegas
- University of North Carolina
- US President's Malaria Initiative
- Virginia Polytechnic Institute

Vietnam
- National Institute of Malariology, Parasitology and Entomology (NIMPE)

Zanzibar
- Zanzibar Malaria Elimination Programme (ZAMEP)

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World Health Organization

To accelerate progress in the fight against malaria

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