



Research

Research is central to our all our work. We develop and test new approaches and products in a range of locations, transmission settings and health systems to help prevent, care and treat malaria, neglected tropical diseases and childhood illnesses. The high-quality evidence

we generate enables us to learn from and improve our projects and programmes, and to support global and national level policymaking for the delivery of effective health services.

Malaria Consortium is one of the world's leading non-profit organisations specialising in the prevention, control and treatment of malaria and other communicable diseases among vulnerable populations.

Our mission is to improve lives in Africa and Asia through sustainable, evidence-based programmes that combat targeted diseases and promote child and maternal health.

Our unique scope

We are committed to ensuring that our all work, programmes and influencing are underpinned by strong evidence and grounded in the lessons we learn through implementation. We do this by:

- pioneering best practices and setting standards for our research with a suite of policies, guidelines and resources for good research conduct across the research cycle
- striving to ensure the highest levels of rigour and integrity so that our national and international partners, the wider public and other stakeholders can have confidence in the research we produce
- putting our research findings into practice or implementation at scale within health systems
- seeking to actively influence policy at national and global levels.

Most of our projects have a research component and, while some of our studies may be standalone, the majority of our research is linked to or embedded in our service delivery programmes. We use a wide range of research approaches and methods, the scope of which includes but is not limited to: implementation and operational research, clinical research, health systems research, health services research, product development and testing, laboratory-based studies and surveillance research. All projects have a plan for engaging with policy makers, programme implementers, practitioners and researchers to inform and influence policy and practice using the most effective strategies.

We have developed and delivered numerous research projects under awards from large multi- and bi-lateral donors and private foundations, such as the World Health Organization (WHO), UK aid and the Bill & Melinda Gates Foundation. These have ranged from smaller projects of US\$50,000 (£38,175) up to projects worth over \$10 million (£7.63 million). We routinely publish our research findings in international, peer-reviewed journals including PLoS One, PLoS Neglected Tropical Diseases, Health Policy and Planning, the American Journal of Tropical Medicine and Hygiene, the Lancet Infectious Diseases and the Lancet Global Health.

Our expertise

1. Implementation and operational research

Our research provides decision makers with information with which to improve the performance of and help identify solutions to problems that limit the effectiveness, efficiency or quality of their programmes.

Assessing and addressing barriers to uptake of intermittent preventive treatment in pregnancy

Uptake of IPTp, typically delivered to pregnant women through routine antenatal care (ANC), remains low in most countries, despite generally high coverage of ANC.

As a key partner in the Communicable Diseases-Health Service Delivery Research Programme Consortium (COMDIS-RPC), we conducted formative qualitative research in Uganda using interviews with 46 women attending ANC, community leaders, health workers and district health officials to explore barriers to IPTp uptake. These revealed that many missed opportunities for IPTp provision during ANC were due to inadequate health worker knowledge of the IPTp provision guidelines and poor service delivery practices, such as not advising women that it is safe to take sulfadoxine-pyrimethamine on an empty stomach.

Based on these findings, we developed a pilot intervention that involved classroom training to introduce the updated national IPTp guidelines and a text message intervention targeting health workers to reinforce the training content.

Further reading: <http://bit.ly/2OE5Zfn>

Operational research to guide implementation of malaria prevention and control activities

Malaria in Ethiopia is unstable and seasonal, and periodic epidemics lead to significant mortality and morbidity. In partnership with Oromia and Southern National, Nationalities and Peoples' Region (SNNPR) Regional Health Bureaus, the Ethiopian Health and Nutrition Research Institute and the London School of Hygiene & Tropical Medicine, we conducted four studies to understand the conditions of malaria transmission in this context and inform regional planning for malaria control in Oromia. These included: i) a retrospective analysis of malaria at health facilities that evaluated changes in the number of cases of malaria seen over a five year period; ii) a feasibility assessment of school-based surveillance of malaria in SNNPR; iii) spatial epidemiology of malaria in Oromia; and iv) a comparison of three rapid diagnostic tests (RDTs) to provide the Ministry of Health with evidence to guide appropriate product selection.

The latter found that all three RDTs were equally sensitive in detecting *Plasmodium falciparum* or mixed infection, all three had similar sensitivity for detecting *P. vivax* infection, and CareStart had higher specificity in detecting *P. vivax*. These findings resulted in policy change around the diagnosis of malaria using multi-species RDTs (e.g. CareStart).

Further reading: <http://bit.ly/2Wjwc3y>

2. Clinical studies

Our research helps to determine the safety and effectiveness of medications, devices, diagnostic products and treatment regimens intended for the prevention, treatment, diagnosis or relief of symptoms of a disease.

Community management of chest in-drawing pneumonia

Pneumonia is the leading cause of death among under-fives and the burden is highest in sub-Saharan Africa. Timely care-seeking and appropriate classification and treatment can reduce pneumonia-related mortality. Yet, many children with severe symptoms do not reach facilities when referred due to geographical, financial and socio-cultural barriers. Community-level management of chest in-drawing pneumonia is safe, effective and reduces the need for referral; however, it has not been rigorously evaluated in Africa.

In this one-arm safety intervention study we aimed to establish whether community-oriented resource persons (CORPs) in Nigeria could safely manage chest in-drawing pneumonia in under-fives. We found that 99 percent of CORPs provided correct clinical management of enrolled children with chest in-drawing pneumonia and that the clinical treatment failure rate was 7.6 percent. The study, therefore, showed that it is safe to treat children with chest in-drawing pneumonia at the community level with close follow up by CORPs, and that community-level management of the infection is acceptable to both CORPs and caregivers. The results have been disseminated at national level.

Further reading: <http://bit.ly/2lQrZLc>

3. Health systems research

We develop and test practical solutions to problems that are either specific to particular health systems or that address a problem common to several countries in a region.

Innovations at scale for community access and lasting effects

The inSCALE project sought to demonstrate that government-led integrated community case management (iCCM) of diarrhoea, malaria and pneumonia could be rapidly expanded without compromising quality of care if solutions could be found to increase community health workers' (CHWs) motivation and performance and strengthen information flow.

Using extensive formative research, we identified two such innovations: mobile phone applications for CHWs that feature job aids to support decision making, data submission and performance-related feedback, and community engagement via village health clubs. We implemented both innovations in Uganda, and just the mobile app in Mozambique.

We evaluated the interventions in a large multi-country cluster randomised controlled trial involving over 2,000 CHWs in the intervention arm and more than 12,000 under-fives. We found that the interventions resulted in a consistent, though not always statistically significant, improvement in appropriate treatment for sick children with diarrhoea, pneumonia and fever. The combined effect of the technology intervention suggests that appropriate treatment coverage could improve by 10 percent. The improvements we observed occurred despite problems with drug stocks and other contextual factors, suggesting potential for greater gains if these issues were also targeted.

The Mozambican Ministry of Health is scaling up the technology intervention in partnership with Malaria Consortium and Unicef, aiming to achieve national reach by 2020. In Uganda, we have scaled up the community intervention under the iCCM–Maternal and Child Survival project, and a follow-up study has shown that the intervention is being sustained by some communities themselves after inSCALE project funding ceased.

Further reading: <http://bit.ly/2U08yew>

4. Health services research

Our research helps to understand how people access healthcare services, the cost implications of different intervention combinations and delivery systems, and the quality of healthcare services.

inSCALE project health economics evaluation

As well as evaluating the capability of the inSCALE interventions to improve coverage of iCCM and timely treatment in Mozambique and Uganda, we also investigated their full cost implications from the provider perspective in a 'real world' setting. The objectives included determining: i) the financial and economic costs of the two innovations to motivate and retain CHWs; ii) the financial and economic costs of implementing iCCM in Mozambique and Uganda; and iii) the incremental cost-effectiveness of each intervention package compared to usual practice (i.e. cost per appropriately treated case).

Preliminary results show that the full financial and economic costs of delivering care for pneumonia, diarrhoea and malaria in under-fives in Mozambique and Uganda varied by the level of facility and was highest in hospitals. The unit costs of treatment in outpatient settings ranged from \$2 to \$16 (£1.50 to £12.10) in Uganda and from \$10 to \$24 (£7.60 to £18.20) in Mozambique; unit costs of treatment were substantially higher in inpatient settings. Seeking care from a Village Health Team had the lowest cost outlay for caregivers of under-fives (median \$0.00, interquartile range (IQR) \$0.00-\$1.80) and seeking care from a private doctor or clinic had the highest (median \$2.80, IQR \$1.20-\$6.00).

Further reading: <http://bit.ly/2vsxhdl>

5. Product development and testing

Our research aims to understand the extent to which interventions, products or devices are safe and feasible to implement in a specific context.

Pneumonia diagnostics devices

Pneumonia is a leading cause of death among under-fives in Africa and Asia. Many countries detect and treat childhood pneumonia using iCCM, but CHWs often have limited access to tools to help assess signs of the infection. Our multi-region project tested the accuracy, acceptability and scalability of automated respiratory rate (RR) timers and pulse oximeters for the diagnosis of pneumonia symptoms by CHWs and first level health facility workers (FLHFWs) in Cambodia, Ethiopia, South Sudan and Uganda. Through a comprehensive landscape review, we identified nine devices for field testing.

We tested the accuracy of these devices in supporting pneumonia diagnosis or measuring oxygen levels by comparing them to a continuous monitor reference. Although none of the four RR timers performed well, the handheld pulse oximeters with multiple probes did and had superior performance to their fingertip counterparts when used by frontline health workers. All the devices performed better when used with older children.

Our results indicate that the currently recommended acute respiratory infection timer used by CHWs should only be replaced by more expensive, equally performing, automated RR devices when aspects such as usability and duration of the devices' use significantly improve the patient-provider experience. Analysis of acceptability and usability as perceived by CHWs, FLHFWs and caregivers is ongoing as part of the "la Caixa" Foundation and Unicef-funded Acute Respiratory Infection Diagnostic Aid (ARIDA) project.

Further reading: <http://bit.ly/2l6ahZR>

Acute respiratory infection diagnostic aid

This project sought to identify and introduce automated RR counting aids that could be used by frontline health workers in resource-limited community settings and health facilities for classifying fast breathing (a symptom of pneumonia). We field tested two such aids in SNNPR, Ethiopia between 2017 and 2018: the Philips ChARM device, which uses an accelerometer to provide a single RR reading with a red or green light to classify the child as having fast or normal breathing for his/her age group, and the Masimo Rad-G multimodal device, which calculates a child's RR and oxygen saturation level – a proxy for very severe pneumonia – after a CHW has selected the child's age group. We also field tested the ChARM device in Nepal using the same study design. The trials included: i) evaluation of the devices' technical performance through dossier review; ii) evaluation of their accuracy; and iii) assessment of their usability by CHWs and acceptability to users and caregivers through field testing.

Findings from the three studies indicate that both devices were acceptable to CHWs, FLHFWs and caregivers in Ethiopia and Nepal, and that CHWs in Ethiopia could better adhere to WHO's case management guidelines and device manufacturers' instructions for managing under-fives with a cough and/or difficult breathing using the devices.

Both devices are now being further tested in Unicef-led implementation evaluations in Bolivia and Ethiopia. We recommend that further studies are conducted to understand the devices' performance and cost-effectiveness.

Further reading: <http://bit.ly/2DE8PKt>

6. Surveillance for disease prevention and control

We collate population-based information on disease occurrence, prevention, treatment and survival and strengthen the scientific basis for prevention and control nationally and globally.

Beyond Garki

Against a backdrop of reduced mortality and morbidity from malaria and changing transmission patterns in many highly endemic countries, we sought to contribute to elimination efforts by expanding the scope and coverage of control interventions in the countries in which we operate. Named 'Beyond Garki' in recognition of the control efforts by the government of Nigeria and WHO in the 1960s and 70s in Garki, Northern Nigeria, the project: monitored changes in malaria epidemiology in the context of implemented interventions, identified determinants of transmission, modified strategies, and improved targeting of control measures to address increasing heterogeneity in transmission. We led the project's implementation in Cambodia, Ethiopia, Nigeria and Uganda.

To assess their impact, we carried out repeated cross-sectional surveys in four sites with varying transmission intensities in Ethiopia and Uganda between 2012 and 2014, and similar studies in Cambodia in 2013 and Nigeria in 2016. These included household surveys, malariometric and serological surveys, entomological surveys, health facility-based morbidity studies and climate studies.

Our surveys showed that malaria epidemiology had changed compared to earlier published data. We also found that individuals who slept under insecticide treated nets (ITNs) were at a significantly lower risk of contracting malaria, and most human-vector contact still occurred indoors, especially with *Anopheles gambiae* s.s. and *An. arabiensis* in Uganda. ITN use varied between sites, but access to nets was an important determinant of net use behaviour among the study populations. High rates of resistance were recorded against pyrethroid insecticides, though malaria transmission had declined substantially in sites that had been exposed to indoor residual spraying.

These interesting patterns indicate that control strategies need to adapt to changing malaria epidemiology. Our surveys also provide important baseline variables against which future changes in epidemiology can be compared and continued regular monitoring can help improve targeted responses to address increasingly heterogenous transmission.

Further reading: <http://bit.ly/2GKKH9L>


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Cover image: Woman participating in ARIDA field trials, Nepal.

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disease control, better health