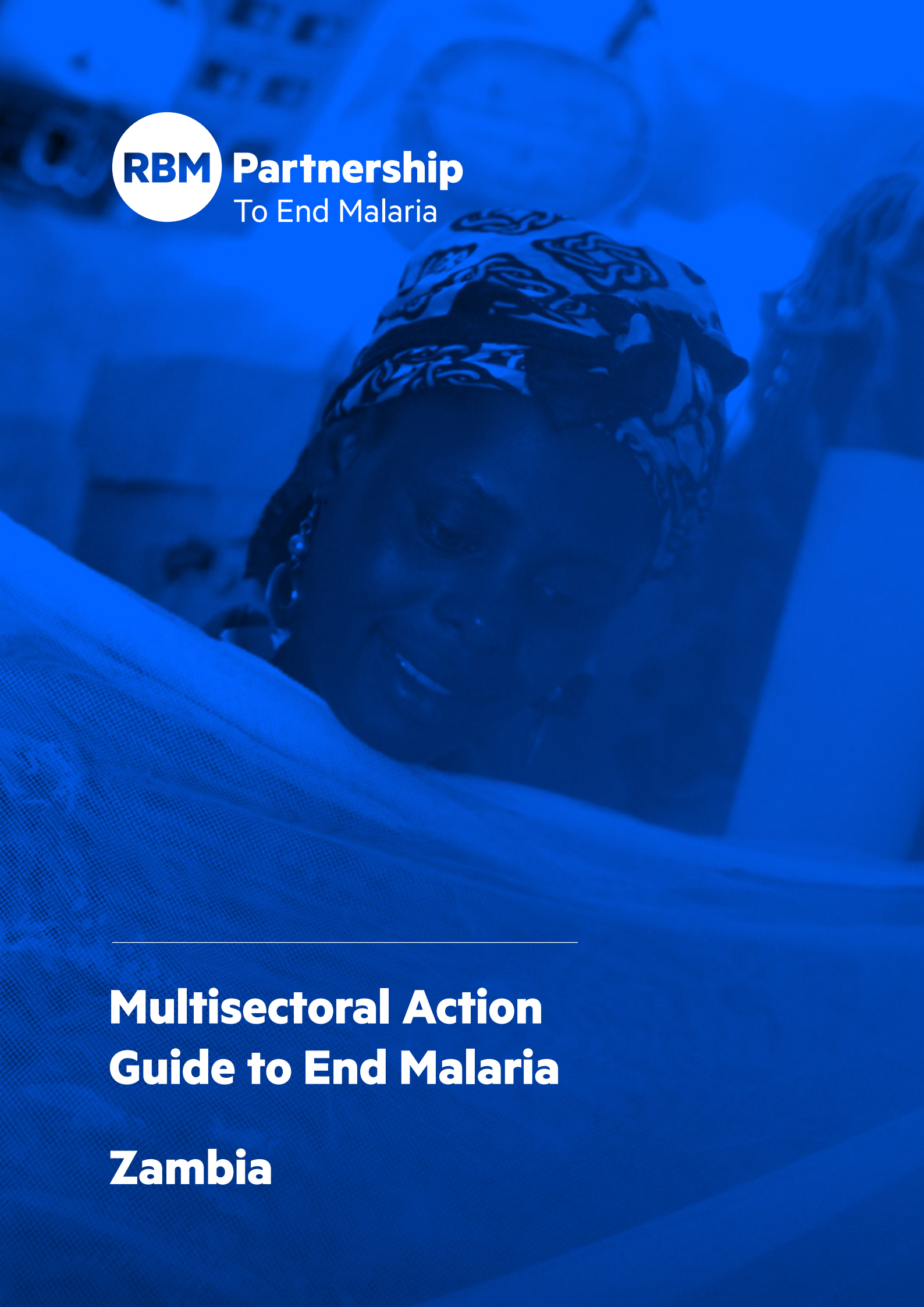

RBM Partnership To End Malaria

Multisectoral Action Guide to End Malaria

Zambia

RBM Partnership to End Malaria — Multisectoral Action Guide to End Malaria Zambia

Credits

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Acknowledgements

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Agriculture

How does malaria impact on subsistence and commercial agriculture?

Agriculture is incredibly important to Zambia, with over 50 per cent of the country's labour force employed in the agricultural sector. As well as health care costs, malaria can strike farmers at critical planting, weeding and harvesting times, thus reducing the labour force and productivity of the land. Food insecurity can lead to undernutrition and lower crop yields will result in lower incomes (if farmers have sufficient crops to sell). In Côte d'Ivoire, cabbage farmers who were sick with malaria for more than two days had 47 per cent lower yields and 53 per cent lower revenues than farmers who missed a maximum of two days. Illness and death of farmers can hinder agricultural innovation, since knowledge acquired is not leveraged to develop new techniques. According to one analysis, in Zambia, eliminating malaria by 2040 would prevent approximately 48 million cases, reducing the number of lost workdays among agricultural households by approximately 211 million days[1].

Irrigated rice and sweet potato production. Photographed by Steven Lindsay.

Which agricultural practices increase malaria risk?

Agricultural practices can increase the risk of malaria in several ways:

- In areas with **irrigated agriculture**, the creation of water impoundments or inefficient drainage leading to water pooling can create ideal habitats for malaria mosquitoes.
- **Deforestation and clearing of land** can either decrease or increase malaria, depending on the setting and mosquito species involved. Deforestation may reduce malaria transmitted by mosquitoes that thrive in heavily forested areas but the creation of partially shaded or open landscapes may increase malaria transmitted by species that live near forests or non-forest mosquitoes.
- **Poor living conditions and lack of access to malaria preventive measures and the formal health care system** may leave agricultural workers at higher risk for malaria.
- The use of agricultural pesticides can drive the development of **resistance to insecticides** that are important to public health, such as those applied to insecticide-treated nets (ITNs).
- **Animal husbandry** can sometimes increase malaria risk. Cattle can provide additional sources of blood for mosquitoes and animal footprints can also create small pools of water where malaria mosquitoes can lay their eggs.
- **Aquaculture** of fish and shellfish can create habitats for malaria mosquitoes, particularly in lakes or in the flooded plains of major rivers.

[1] D.W. Willis and N. Hamon, "Eliminating malaria by 2040 among agricultural households in Africa: potential impact on health, labor productivity, education and gender equality", Gates open research, vol. 2, No. 33 (2018).

How can the agricultural sector take action against malaria?

The Zambia National Malaria Elimination Programme (NMEP) envisions a malaria-free Zambia. The Ministry of Agriculture can support malaria elimination by proactively engaging with farmers, farmers' cooperatives and unions, commercial farms, agricultural suppliers, agrochemical companies, education and research establishments and nongovernmental organizations. Coordinated actions across these stakeholders can help to reduce malaria.

Health impact assessment

- Large agricultural projects should undertake a health impact assessment, which should include the assessment of malaria impacts.
- The Zambia Environmental Management Agency (ZEMA), NMEP or another government actor should enforce any actions recommended in the health impact assessment to reduce malaria risk.

Pooling at edge of irrigated sugarcane field. Photographed by Steven Lindsay.

Larval source management

Environmental management to reduce malaria risk requires consideration of the topography, water supply, crops, and local customs and agricultural practices. Before implementing measures, close collaboration is required with public health / agricultural engineers, communities and other stakeholders. Potential options include:

- Switching to irrigation types that reduce the pooling of water (e.g. sprinkler not flood irrigation).
- Implementing good irrigation practices to prevent overirrigation and water accumulation:
  - Filling soil depressions and levelling the border of flooded fields to ensure that no water pools remain when the floodwater is withdrawn.
  - Ensuring the correct operation of sprinkler systems, including repairing any leaks.
  - Ensuring drainage canals are free of debris and flowing well. Consider lining the drainage canal and conducting regular maintenance to repair the banks or clear silt.
  - Intermittent drying of fields, since the intermittent irrigation of rice can reduce malaria mosquitoes and has been shown to save water without reducing rice yields.
- Managing the shoreline of water impoundments for irrigation, including deepening and removing floating vegetation that can harbour mosquito larvae.
- Introducing novel crop varieties that do not require the flooding of fields or require less water.
- Larviciding using chemical or microbial larvicides (larger areas can be larvicided by air).
- Introducing larvivorous fish (fish that feed on mosquito larvae) into commercial fishponds.

Changes to animal husbandry

- Try to keep animals away from homes when the presence of livestock close to humans increases malaria risk.
- Consider treating livestock with insecticide if there is evidence this will be effective, such as in places where malaria mosquitoes are outdoor biting and feed on both humans and animals.
- Understanding the linkages between animal and human health, implementing an integrated one-health approach among communities practising animal husbandry to maintain the health of livestock and humans (e.g. integrated animal vaccination and bednet distributions).

Animal waterhole harbouring mosquito larvae. Photographed by Steven Lindsay.

Abandoned fish pond providing a larval habitat. Photographed by Steven Lindsay.

Legislation and enforcement

- Bring forward legislation to ban mosquito habitats on farms. For example, in Khartoum, Sudan authorities mandated intermittent drying of fields with penalties for farmers that do not comply.
- Encourage sparing use of agricultural and public health pesticides, in line with the relevant guidelines issued by ZEMA and paying attention to insecticide resistance management.

Training of farmers and agricultural engineers

- Add malaria prevention, particularly on environmental management, to college and university curricula.

Protecting agricultural workers and their families

- Provide personal protection (e.g. ITNs, topical and spatial repellents) for farm workers.
- Ensure farmers are educated on the risk of malaria and have access to health care to allow rapid diagnosis and treatment.
- Mosquito-proofing of housing of farm workers, including screening doors and windows, closing eaves, installing metal roofs and raising houses off the ground if possible. Situate new farm housing away from areas of possible malaria risk, such as forest fringes and water bodies.
- Agricultural extension programmes should be encouraged, as they can help reduce malaria through an increase in income and the purchasing of ITNs.
- Raise awareness of the risk of malaria among farming communities.

Financial and in-kind contributions

- Provide support to the NMEP, for example training community health workers at commercial farms/ cooperatives and financial and other in-kind contributions to malaria control.

Stakeholders:

Collaboration between the different stakeholders involved in agriculture is essential:

Government authorities	Farmers cooperatives and unions	Commercial farms	Agricultural suppliers	Education/ research establishments	NGOs
Ministry of agriculture	Zambia National Farmers Union	Zambia Sugar	Afriseed	Zambia Agricultural Research Institute	Musika
			Irritech	Zambia College of Agriculture	
ZEMA	Zambia Cooperative Federation	Zambeef	Export Trading Group Zambia	Indaba Agricultural Policy Research Institute	Self Help Africa

Energy

Opportunities and risks of energy production and consumption

Energy is a major driving force of economic development in Zambia. Hydroelectric power makes up 85 per cent of the country's energy, using the vast water resources of the mighty Zambezi and Kafue rivers. Achieving universal access to electricity by 2030 and bridging the gap in access between rural and urban areas will require additional generation capacity. Solar, wind and thermal power is being increasingly explored, alongside continued investment in hydropower. The main risk of malaria comes from the building of hydroelectric dams, which create reservoirs that can harbour malaria mosquitoes. The impact of dams on malaria transmission depends on the climate and topography, dam design and operations, and the epidemiological profile of the area. The relationship between electricity access and malaria is complicated and can either increase or decrease malaria, depending on the context. Access to electricity and eliminating malaria are both important development objectives that can help raise populations out of poverty and should be considered together as part of a joint multisectoral strategy. The opportunities and risks of energy production and consumption related to malaria are:

Opportunities	Risks
Indoor lighting and cooking may keep people indoors during peak biting hours, limiting exposure to mosquitoes outdoors.	Hydroelectric dams and water impoundments can increase habitats for malaria mosquitoes.
Fans and air conditioning create a more comfortable indoor environment, reducing outdoor sleeping and promoting the use of bednets.	Construction machinery and vehicles can create malaria mosquito habitats through water pooling.
Health care facilities do not need to rely on unreliable generator power and can open for longer.	Construction workers on hydroelectric dams may be at higher risk of malaria due to poor housing and lack of access to health care.
More access to media and telecommunications provides more opportunities for behaviour change communication messages.	Fans and air-conditioning may reduce bednet use.
Access to electricity promotes economic growth, leading to improved health outcomes.	
Health care facilities with electricity access are better able to conduct malaria microscopy and access e-health tools for, telemedicine decision support and case recording and reporting.	Outdoor lighting and watching television outdoors can increase the duration of outdoor activity and attract malaria mosquitoes.

How can the energy sector take action against malaria?

The Zambian NMEP envisions a Zambia free from malaria but we need all sectors, including the energy sector, to play a part in making this vision a reality.

Hydroelectric dams:

Before construction:	• Ensure the potential impact on malaria is assessed during any health impact assessment and enforce any measures recommended to reduce malaria risk. • Encourage the building of dams in highland areas (above the altitude for malaria transmission) or in areas of low malaria prevalence.
During construction:	• Ensure heavy machinery and vehicle movement does not contribute to malaria mosquito habitats through filling, levelling or larviciding. • Create steep and straight reservoir sides to discourage shallow water and mosquito habitats. • Ensure construction workers have access to malaria-proof housing (e.g. screened windows and doors, closed eaves, metal roofs), preventive tools (e.g. insecticide-treated bednets) and diagnosis and treatment. • Displaced communities should be relocated away from mosquito habitats and have mosquito-proof homes, including screening.
During operation:	• Encourage rapid drawdown and fluctuation of water levels to prevent shallow pools that may harbour malaria mosquitoes. • Conduct mosquito surveillance. • Ensure environmental management is used on irrigated agricultural land adjacent to reservoirs. • Keep shorelines free of vegetation to prevent mosquito habitats.

Access to electrification and public health messaging

- Prioritize electricity access for malaria-endemic areas and health care facilities.
- In electrified areas, increase behaviour change communication on malaria prevention, including not staying outdoors after dark, wearing long clothes, using topical and spatial repellents and the need for continued bednet use despite the availability of fans.

Financial and in-kind contributions

- Provide financial and in-kind support to the NMEP, for example the transport of commodities like bednets and supporting staff training and community events.

Stakeholders:

Collaboration between the different stakeholders involved in energy production and use is essential:

Government authorities	Utility companies	River authorities	Other private sector	Donors
Water Resources Management Authority	Zesco	Zambezi River Authority	General Electric Power China	World Bank
				African Development Bank
				USAID Power Africa
				U.S. Trade and Development Agency

Housing & infrastructure development

Up to 90 per cent of malaria transmission in sub-Saharan Africa occurs inside the home at night. This is because in many homes, open eave spaces, thatched roofs and a lack of screening for ceilings, windows and doors allow malaria mosquitoes to easily enter homes and bite people. Fortunately, there is strong evidence that improved housing protects against malaria compared to traditional housing. One study found that residents of modern housing had around half the number of malaria episodes compared to those living in traditionally constructed homes.[2]

Economic growth is improving housing conditions in Zambia but there is still some way to go. In 2015, around 40 per cent of Zambians still lived in houses made of natural materials, including adobe walls and thatch roofs.[3] The growing population and increased need for new housing provides a golden opportunity to transform how we build houses so that they can prevent malaria.

How can the Ministry of Housing and Infrastructure take action against malaria?

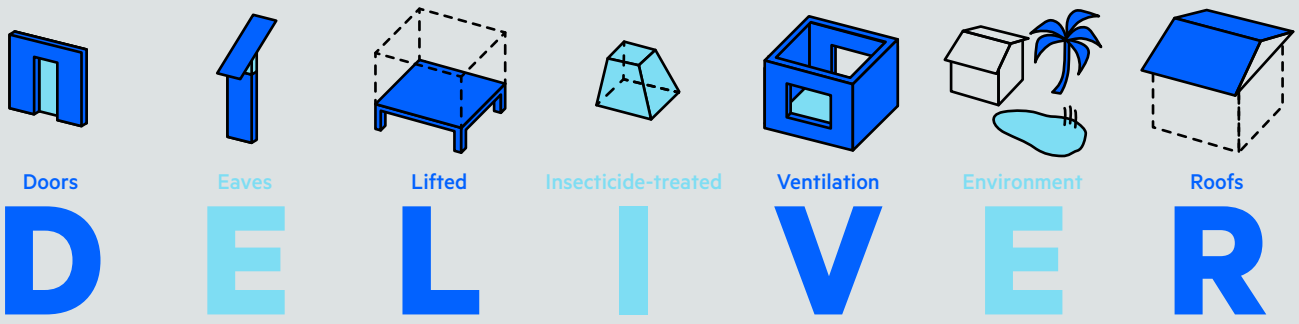
The Zambia NMEP envisions a malaria-free Zambia. All sectors, including the housing sector have an important role to play in achieving this goal.

Making houses and the peri-domestic environment malaria-smart

There are six simple recommendations for reducing malaria transmission in homes. These can be summarized by the DELIVER mnemonic:[4]

[2] L.S. Tusting and others, "The evidence for improving housing to reduce malaria: a systematic review and meta-analysis", *Malaria Journal*, vol. 14, No. 209 (2015).
[3] L.S. Tusting and others, "Mapping changes in housing in sub-Saharan Africa from 2000 to 2015", Nature, vol. 568, No. 7752 (2019).
[4] S.W. Lindsay and others, "Recommendations for building out mosquito-transmitted diseases in sub-Saharan Africa: the DELIVER mnemonic", Phil. Trans. R. Soc. B, vol. 376, No. 1818 (2021).

Photographed by Steven Lindsay.



D	**D**oors should be screened, self-closing and without surrounding gaps
E	**E**aves (i.e. the space between the wall and roof) should be closed or screened
L	Houses should be **L**ifted above the ground since this reduces the entry of malaria mosquitoes that usually fly at low levels
I	**I**nsecticide-treated bednets should be used when sleeping in houses at night and indoor residual spraying of Insecticide should be conducted by the NMEP.
V	Houses should be **V**entilated, with at least two large screened windows on either side of the building to facilitate airflow
E	**E**nvironmental management should be conducted regularly inside and around the home (e.g. removing water containers, filling water bodies, ensuring drainage channels are flowing)
R	**R**oofs should be solid, rather than thatch, where possible, or gaps in thatched roofs should be filled if switching from thatch is unaffordable

How to scale up these malaria-smart house improvements?

- Engage local manufacturers, distributors and importers of housing materials (e.g. screening, solid roofing materials) to make these more affordable and widely available.
- Liaise with architects, landscape architects, structural and civil engineers and town/urban planners directly or through trade bodies to share best practices on malaria-safe housing and construction.
- Introduce house improvements to reduce mosquitoes into building codes for new private housing and social housing schemes.
- Support incremental housing improvements by communities through saving and borrowing schemes (e.g. housing microfinance).
- Develop behaviour change communication to encourage incremental house improvements that reduce mosquito entry.
- Support bank access to liquidity and long-term finance for mortgages and developers.
- Engage the Land Registry to enhance land administration practices and markets. Address the issue of insecure land tender, since if residents do not have the security that they will not be moved on by the authorities, there is no incentive to improve their homes.

Closing eave gaps. Photographed by Steven Lindsay.

Housing and infrastructure development

- Infrastructure projects should undertake a health impact assessment, including assessment of malaria impacts. ZEMA, NMEP or another government actor should enforce any actions recommended in the assessment to reduce malaria risk.
- During house construction, builders often create concrete basins or dig brick pits, both of which can become habitats for malaria mosquitoes. These construction sites should be treated with larvicide or drained regularly and removed promptly once construction is complete.
- Consider mandating that construction sites engage an environmental protection officer to control pests, including malaria mosquitoes.
- Enact laws mandating mosquito-free construction sites and consider imposing penalties for the contravention of these laws.

Diagnosis and treatment

- Health care providers should address the needs of those living in informal settlements, including providing access to essential services, such as malaria diagnosis and treatment.

Financial and in-kind contributions

- Construction and building material companies can provide financial and in-kind support to the NMEP including the transport of bednets and other commodities, support for staff training and community events.

Photographed by Steven Lindsay.

Stakeholders:

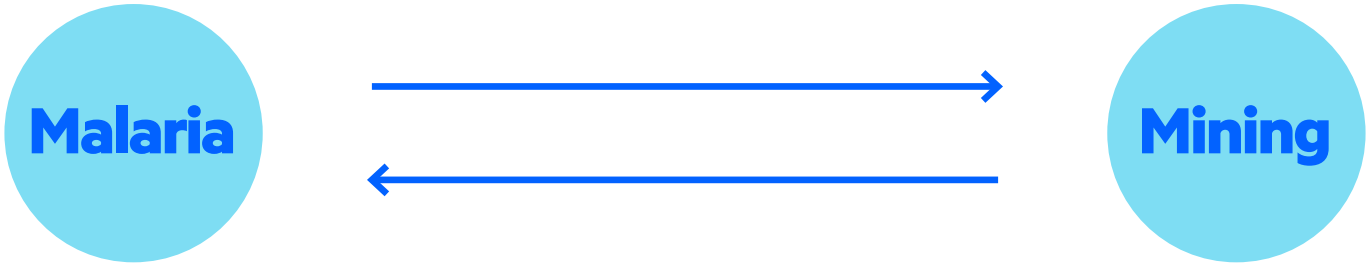
Given the major impact of housing and urban development on malaria transmission, the government should advocate for more involvement of relevant stakeholders including:

Government ministries and authorities	Construction industry	Financial institutions	Academic and research institutions	NGOs and faith-based organizations
City Councils	Housing developers	Banks and mortgage providers	Schools of Architecture and built environment	Housing Cooperative Societies
National Council for Construction	Manufacturers and distributors of housing materials			
National Housing Authority Zambia	Architects and landscape architects			
Ministry of Lands and Natural Resources	Town and urban planners	Housing and other microfinance institutions		Habitat for Humanity
Environmental health authorities	Structural and civil engineers			
Ministry of Local Government, Department of Physical Planning	Industry and trade bodies e.g. Zambia Institute of Architects			

Mining

Mining is a major driver of economic growth in Zambia, particularly copper mining in the copper belt and northwestern provinces. Given the vulnerability of mining communities to malaria and the potential for mining practices to increase its transmission, it is important that the health and mining sectors work together to reduce the impact of malaria on the health and productivity of the workforce. Large-scale mining operations in Zambia are conducted by large companies with organizational and financial resources to manage vector habitats, rehabilitate mining sites after operations are completed and provide malaria prevention, diagnosis and treatment services for miners and their communities. However, artisanal and small-scale mining, particularly of gemstones, gold and manganese is on the rise. Not only is this type of mining potentially more hazardous to the health and safety of the workforce, it is also more likely to promote mosquito habitats and malaria transmission.

1. **Absenteeism and reduced workforce productivity**
2. **Falling profit margins**



1. Surface trenches, pits and tyre tracks can fill with water and create habitats for malaria mosquitoes
2. The high prevalence of multi-morbidity, including HIV, tuberculosis and non-communicable diseases, increases susceptibility to malaria
3. Poor housing quality (e.g. lack of screened windows) increases the risk of malaria mosquitoes biting
4. High mobility of the workforce can reintroduce malaria infection into other communities, threatening malaria elimination
5. Mines, particularly (artisanal and small-scale mining) are often located in remote areas with limited infrastructure and less access to health care

Stakeholders:

Given the important links between mining and malaria in Zambia, the government should advocate for greater involvement of relevant stakeholders including:

Government agencies	Mining companies and Trade Bodies	NGOs / not-for-profits/Donors
ZCCM Investments Holdings Plc	Zambia Chamber of Mines	CHAMP
Ministry of Labour, Mine Safety		Society for Family Health
Municipal Councils	International Council on Mining and Metals	
Ministry of Health, NMEP,, Occupational Health and Safety Bureau		U.S. President's Malaria Initiative

How can the mining sector take action against malaria?

The Zambia NMEP envisions a malaria-free Zambia. All sectors must play their part in achieving malaria elimination. The Ministry of Mines and Mineral Development should support the establishment of publicprivate partnerships with mining companies to address gaps identified by the Ministry of Health, including the provision of health and malaria vector control services. There are also a number of specific actions the ministry can promote:

Health impact assessment

- Mandate that malaria impacts be assessed during any health impact assessment, including the baseline assessment of malaria risk.
- ZEMA, NMEP or another government actor should enforce any actions recommended in the health impact assessment to reduce malaria risk.

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Larval source management

- Copper mining in Zambia has a long history of effective environmental management to reduce malaria burden through for example clearing vegetation near water bodies, draining swamps, larviciding of ponds and removing unused infrastructure, and this experience should be used.
- Local government or NMEP should conduct spot checks to ensure malaria mosquito habitats are dealt with appropriately and should consider fines if not.
- Mandate that mining companies employ (or seek the services of) a pest control officer to manage malaria mosquitoes and other pests.

Preventing biting

- The housing of mine workers and surrounding communities should be mosquito proofed using screening, solid roofs, raising houses on stilts and closing eave gaps.
- Ensure high coverage and use of insecticidetreated bednets and indoor residual spraying.
- Encourage the use of insecticide-treated clothing or topical repellents if workers are active during peak biting times.

Occupational health and access to malaria services

- Provide health care infrastructure for mine workers (including contractors) and surrounding communities for malaria prevention, diagnosis and treatment services.
- Ensure data on malaria cases and deaths is shared or integrated into the national data system.
- Provide targeted community education and outreach services for artisanal and small-scale miners, including those working illegally.
- Provide training on malaria personal protection and the importance of seeking diagnosis and treatment, both upon employment and at regular intervals.
- Strengthen occupational health and safety regulations to include regular testing for malaria, alongside current annual testing for sexually transmitted infections and silicosis.
- Encourage companies to keep records of workrelated injury and illness, including from malaria.
- Seek support from mining companies for training health professionals.
- Provide malaria prophylaxis for workers coming from non-endemic areas.
- Offer malaria screening and treatment for workers entering and leaving mining sites.

Financial and in-kind contributions

- Mining companies can provide financial and in-kind support for malaria elimination such as transport of commodities for indoor residual spraying and ITNs and sponsoring promotional materials for National Malaria Day.

Telecommunications

Telecommunications includes radio, television and fixed and mobile telephone and Internet services. Mobile telecommunications have a particularly broad reach in Zambia: over 80 per cent of the population have access to a mobile phone and over 45 per cent use mobile Internet. The NMEP envisions a malariafree Zambia, which will require all sectors, including the telecommunications sector, to play their part in eliminating the disease.

How can the telecommunications industry support malaria elimination?

Radio and television:

Radio and television channels can share social and behaviour change communication messages on malaria prevention and treatment. These messages should be at peak viewing times (e.g. before football matches) and should be led by popular and respected media figures.

Photo credit: Ron Haviv, RBM Partnership to End Malaria

Photo credit: African Leaders Malaria Alliance (ALMA)

Fixed and mobile telecommunications:

There are several ways that mobile phone communications and text messages can help malaria elimination:[5]

1. Case reporting by health care facility staff and community health workers.
2. Monitoring of the availability of health commodities.
3. Pharmacovigilance and post-marketing surveillance of the safety and quality of antimalarial drugs.
4. Health care worker adherence to guidelines.
5. Patient adherence to medication regimens, and post-treatment review (e.g. artemisinin-based combination therapy and intermittent preventive treatment of malaria in pregnancy).

To support these activities the End Malaria Council/NMEP could request:

- Financial support for the provision of phones and tablets to health care facility staff and community health workers for case reporting, commodity reporting and pharmacovigilance.
- Provision of phone credit for health care facility staff and community health workers.
- Sharing of malaria social and behaviour change communication messages to customers by text message or through holding music when calls are being connected. These can be regular or timed to coincide with National Malaria Day, periods of high malaria risk (e.g. flooding) or focused on high-risk geographic areas. A text message campaign could be combined with texting to make a financial pledge by recipients to support malaria elimination, offering the chance to win prizes.[6]
- Preferential rates for installation of internet and phone services for NMEP and health services.

Other opportunities for greater involvement of the telecommunications industry include:

- Support from corporate social responsibility initiatives run by companies in the sector for malaria activities. For example, MTN runs the "21 Days of Y'ello Care" campaign, a staff volunteer initiative to support high-impact social projects in local communities. Every year there is a dedicated theme and the NMEP or End Malaria Council would need to advocate for a malaria theme. Similarly, Airtel have a partnership with the Ministry of Education to refurbish and equip primary schools and Zamtel have a safe water focus. While these two companies have dedicated themes, there may be potential to influence priorities.
- Target customers of telecommunications businesses to donate a percentage of their bills to malaria.
- Potential for the contribution of mobile money:
  - Text message campaign and encourage financial donations to the malaria programme.
  - Mobile money saving scheme, targeting spending on malaria-smart incremental housing improvements (e.g. screening).
- Sharing of anonymized phone record data to help understand population movements and the development of risk maps as the malaria burden falls.

Stakeholders:

Government and authorities	Private sector
Ministry of Transport and Communications	Airtel
Zambia Information and Communications Technology Authority	Zamtel
Zambia National Broadcasting Corporation	Private television and radio stations

[5] D. Zurovac, A.O. Talisuna and R.W. Snow, "Mobile phone text messaging: tool for malaria control in Africa", PLoS Med, vol. 9, No. 2; W.R. Briege, "Mobiles for malaria", Africa Health, vol. 34, N o. 6 (September 2012).

[6] Johns Hopkins Center for Communication Programs, "Ugandans Fight Malaria with Cell Phones", 31 July 2011.

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To End Malaria

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