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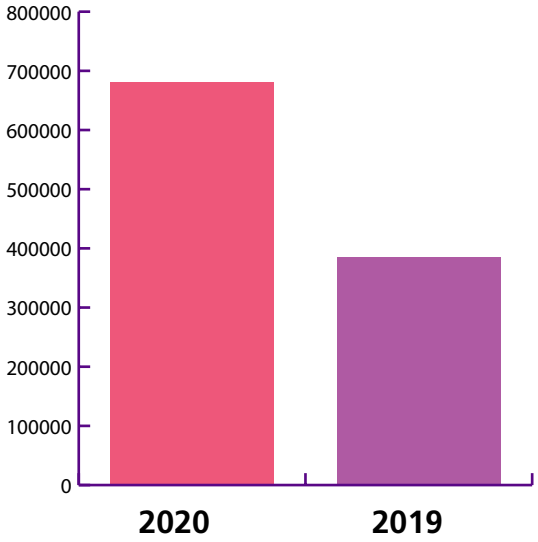
False solutions to the malaria challenge in Africa

The dominant narrative underpinning current malaria interventions is constructed as follows:

Major progress was accomplished in fighting the deadly disease

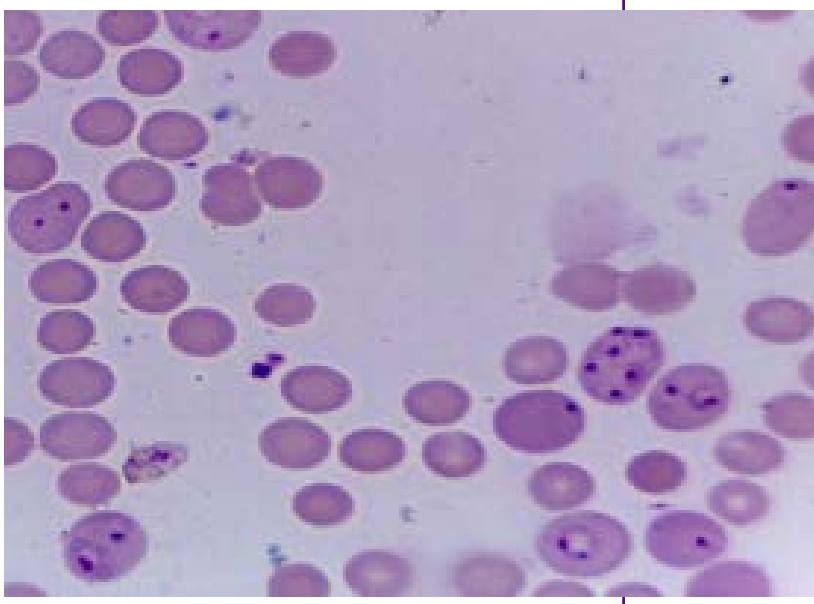
The number of deaths in Africa due to malaria reduced by 50%



but the pace of decrease in cases and deaths has slowed (WHO, 2020a), and in some African countries, even reversed (WHO, 2021).

Following this narrative, the argument goes as follows:

Eradication efforts are failing due to the parasite (P. falciparum is the most common parasite in Africa) and the vector (the mosquitoes that transmit it to humans) evolving constantly (as natured does) and developing resistance to existing tools (pesticides).



The World Health Organisation (WHO) points to several countries with moderate or high transmissions that are now stalling in their eradication effort (2020a:23).

According to the WHO, more money is required for countries to procure the standard vector control technological tools:

- **insecticide treated nets (ITNs)**
- **larval source management (LSM)**
- **indoor residual spraying (IRS)**
- **topical application of insecticides**

This preoccupation with highly technological solutions is detracting from effective and innocuous solutions, embedded in bolstered local capacity and people-centred, well-resourced public health systems.

PHOTO: PRIME_KELLEY LYNCH, 2015

PHOTO: CARSTEN TEN BRINK

Still life with mosquito net

Improved housing and sanitation, equitable land and resource use and management, and agroecological agricultural practices are vastly ignored in the global malaria discourse. Yet, these have proven to be highly efficient elsewhere, in enabling people to lead disease-free lives.

However, the dominant narrative is to keep rolling out existing technological "solutions", as well as new, imported ones that are based on risky synthetic biology, such as gene drive mosquitoes.

- Will these interventions bring about lasting changes in malaria curves for Africa?
- Are new drugs and more nets treated with new insecticide formulae needed to fight resistance?
- Will Africa favour the eventual and inevitable release of gene drive mosquitoes over sovereign solutions that place derelict public health care systems and people at the centre of the fight against malaria and other tropical diseases?

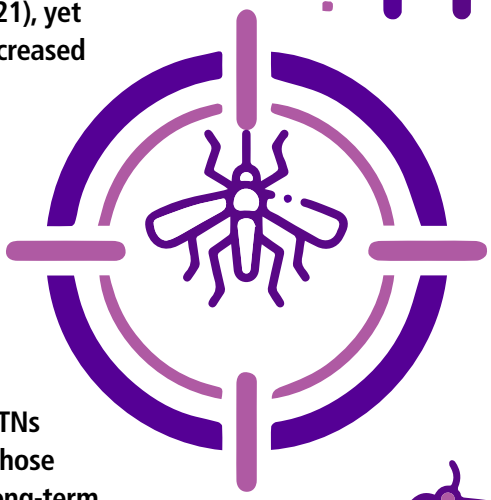
Current malaria prevention and treatment measures

Bed nets and resistance to insecticides

Bed nets are the standard preventative measures promoted at the household level – untreated or treated with insecticides.

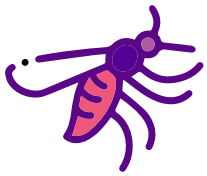
More than **1.9 billion** insecticide-treated nets (ITNs) were distributed in sub-Saharan Africa between 2004 and 2019 (Lindsay et al., 2021), yet malaria figures have not decreased proportionately.

In 2019, only **36%** of households owned a bed net for every two persons – this is just a 1% increase from 2000 (Lindsay et al., 2021).



There are also several reports of sub-standard ITNs being distributed in Africa, especially in Burkina Faso in 2010 and Rwanda in 2015 (Lindsay et al., 2021).

While the WHO claims that ITNs pose **no health risks** to those who sleep under them, no long-term studies have been conducted on the risks of exposure to insecticide over time (Anyanwu et al., 2006).



In addition, as of 2020, more than **70 countries** had reported that mosquitoes were developing resistance to the insecticides used to treat bed nets (Schreiber and Gonzalez, 2020)

Resistance

With time, malaria-carrying mosquitoes can start to withstand or tolerate the effects of an insecticide by becoming resistant to its toxic effects by way of natural selection and mutations.

Growing concerns around resistance have hugely contributed towards orientating malaria funding towards research and development focused on options to manage resistance and vector control (Lindsay et al., 2021). This has marginalised funding for on-the-ground practical support, such as improved water and sanitation services and publicly funded healthcare delivery.

Antimalarial drugs and resistance to them

The first well-known antimalarial drug was the quinine compound derived from the cinchona bark found in South America (Arrow et al., 2004). After years of unsuccessful testing, scientists discovered resochin, which later became known as chloroquine (Arrow et al., 2004). Chloroquine along with DDT were widely used in the WHO's post-World War II global campaigns to eradicate malaria. Reports of resistance to chloroquine soon arose, however, and the search was on again for different compounds that would be effective against malaria (Arrow et al., 2004). The most recent widely used antimalarial drug is artemisinin (Arrow et al., 2004) and its related derivatives. More than 60 countries have, however, reported resistance to artemisinin in malaria carrying mosquito populations and in parasites (Shretta et al., 2017). A 2021 study conducted in Rwanda provided the first scientific evidence that there is resistance to artemisinin in Africa (Sullivan, 2021).

Chloroquine along with DDT

Local solutions and artemisia

A 2014 study notes that tea infusions of dried artemisia leaves can be effective against malaria and that in this form, 40-fold less artemisinin was needed to have the same response as pure artemisinin (Weathers et al., 2014). The study notes that, as the plant can be grown locally and does not require processing beyond drying, it would make for an affordable malaria treatment option in Africa (Weathers et al., 2014). These findings were, however, rejected by the WHO and other global health institutions. More investment in research and development is required, to move away from the economic rationale that underpins the use of the plant in its highly processed form.

False solutions to the malaria challenge

SOURCE: HTTPS://FLIC.KR/P/7WKVN6

U.S. Army medical researchers take part in World Malaria Day 2010, Kisumu, Kenya April 25, 2010

Malaria vaccine

There has been much hype over the past decade about antimalarial vaccines.

The European Medicines Agency approved the genetically modified RTS,S/AS01 (trade name of Mosquirix) for trials (Le Monde, 2021). But early field trials indicated that in children exposed to higher-than-average rates of malaria, there were slightly more malaria cases in those who had been vaccinated than in the control group five years after vaccination (Olutu et al., 2016). The WHO requested that the vaccine's benefits be tested in real-life conditions. This resulted in a controversial trial phase, in which the parents of children subjected to the trials were not fully informed of the risks, which included an increased risk of contracting meningitis and cerebral malaria, as well as of death – particularly in girls (Doshi, 2020).

The vaccine was, however, approved by the WHO in October 2021 (Sullivan, 2021) and is currently being rolled out as a pilot programme in Malawi, with Ghana and Kenya reported to follow (WHO, 2021). RTS,S/AS01 provides only a 30% effectiveness against death and other measures such as bed nets and antimalarial drugs are promoted alongside the vaccine. Hence, the risk of resistance remains (Sullivan, 2021). In April 2021, Oxford University announced the development of a modified version of the vaccine – RTS,S, R21-MM – which showed much higher efficiency levels (up to 77% compared to the 30% of its predecessor).

While the development of these vaccines is country and donor-funded, they are all patented and licensed out, with royalties owed to developers. The vaccines will be bought with public and donor funding and disseminated to Africans. This is a prime example of public and philanthropic funds being used to create private capital. Profiteering from malaria is more fully canvassed in our paper, The financialisation of malaria in Africa: Burkina Faso, rogue capital & GM/gene drive mosquitoes.

GM and gene drive mosquitoes

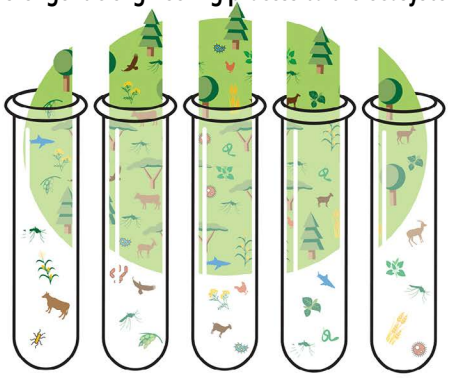
Resistance to insecticides and the fact that "current approaches for prevention of mosquito-borne diseases are immeasurably inefficient" (Akbari Lab, 2021) are ironically often cited as factors that warrant "innovative control methods" (Li et al., 2021; WHO, 2021), such as the use of genetically modified (GM) and gene drive mosquitoes, through a project called Target Malaria. Target Malaria is funded by the Bill and Melinda Gates Foundation and the US Defense Advanced Research Projects Agency (DARPA).

The gene drive technique focuses on completely altering the genetic make-up of a species, notably a wild population. It is referred to as a wildlife extinction technology. Gene drives are being used in two ways – to try to suppress a genetic trait (such as the ability to carry the malaria parasite) in mosquitoes (population alteration), or to try to eradicate the population altogether by introducing sterility genes (population suppression) (ACB, 2018; AU and NEPAD, 2018).

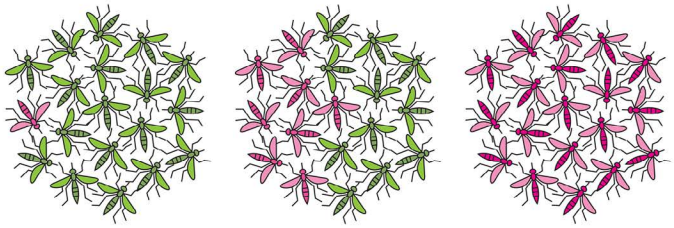
In population alteration, the inherited modified gene can be spread quickly in a population over multiple generations (in contrast to genetic modification of crops and microorganisms) (AU and NEPAD, 2018). In population suppression, the entire population is anticipated to die. New genetic engineering techniques using genome editing tools, such as Clustered Regularly-Interspaced Short Palindromic (CRISPR)/Cas9) are being used to forever change wild populations – and therefore the ecosystems they live in (ACB, 2018).

NOVEL FEATURES OF GENETIC DRIVES:

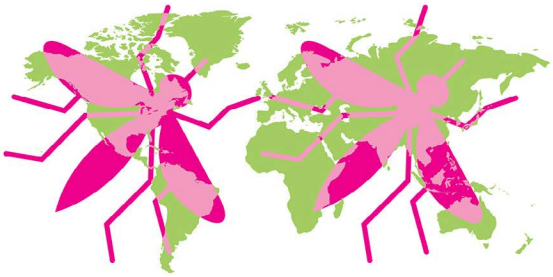
1. Transfer gentic engineering process to the ecosystem



2. Designed to spread



3. Modify wildlife, not cultivated species



A wide array of controversial tools based on genetic modification are being aggressively tested in the southern hemisphere. The African Union (AU) has set a goal of eliminating malaria by 2030 (AU and NEPAD, 2018) and is a strong supporter of gene drive mosquitoes.

PHOTO: DOMINIC CHAVEZ/WORLD BANK GROUP

PHOTO: © DOMINIC CHAVEZ: THE GLOBAL FINANCING FACILITY

Community Health Workers in Burkina Faso

GM mosquito releases in Burkina Faso

The African Union (AU) and New Partnership for Africa's Development (NEPAD) High-Level Panel on Emerging Technologies has identified gene drive mosquitoes as a priority technology for malaria elimination (2018). In 2021, the WHO explicitly endorsed the use of these technologies, arguing that "genetically modified mosquitoes could be a powerful and cost-effective tool to supplement existing interventions" (WHO, 2021b). The ACB has written extensively on the risks involved in the adoption of these technologies and about the capitalistic paradigm in which they are being pushed onto the African market. We have severely criticised the AU for its undemocratic endorsing of gene drive applied research and deployment, especially since there are no international governance standards for the release of such mosquitoes. Further, there is no certainty that the deployment of the technology will reduce, let alone eradicate, malaria transmission (ACB, 2018). GM technologies pose unacceptable risks to national sovereignty, as countries will not be able to choose their level of exposure to the technology and its spread. Additionally, many of Africa's biosafety risk assessments and regulatory capacities are not able to deal with the threats posed (ACB, 2018).

Raising concerns

Concerns about the implications of gene drives becoming an accepted response to health and food security challenges include the following:

The European Network of Scientists (2021:1) note that there is a "real possibility of these gene drive organisms causing alteration, suppression, or extinction of the target species, far beyond the intended geographic area", which could cause irreversible changes to biodiversity and food webs.

Other serious concerns include:

- The ability to control the dispersal of the GM species, once it is released, is purely speculative, and the longevity of its lifespan impossible to predict. The precautionary principle based on a risk averse approach therefore needs to be applied.
- The irreversible nature of implementing gene drives is not considered and the ability to reverse gene drives is unknown, as the research is still in development phases and based on modelling in laboratories in the North.
- Possible transmission of the altered gene to non-target species is a major concern. Gene drive organisms could transmit the gene drive through crossbreeding and horizontal

gene transfer – where genetic material is transferred through processes other than reproduction.

- While there are assumptions that risks can be predicted and managed, there is no certainty, particularly in Africa, where experience and biosafety capacity and resources are scarce.

The way forward

It is clear that the most beneficial and sustainable solutions include ensuring people are well informed – about the spread and prevention of malaria.

The African state should invest in providing African citizens with adequate and equitable access to basic services for drinking water, waste management and sanitation.

Further, the African state must ensure a reduction in the proliferation of breeding grounds for malaria-carrying mosquitoes and provide access to effective and affordable publicly-funded healthcare.

However, how a country determines its response to malaria is often not based on the most logical, efficient and affordable solutions, but rather it is shaped by vested interests of both those who are in internal decision-making bodies and those who seek to profit from external programmes to combat malaria in Africa.

In this sense, responses can be said to be shaped by the logics and interests of finance, rogue capital and politicians. This is more fully explored in our paper, The financialisation of malaria in Africa: Burkina Faso, rogue capital & GM/gene drive mosquitoes.

Find out more

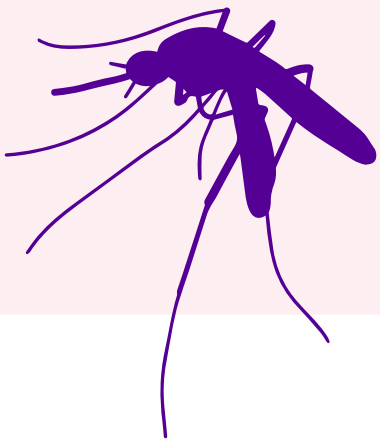
Fact Sheets

What you need to know about malaria

Malaria: What drives it?

Briefing paper

Gene Drive Organisms: What Africa should know about actors, motives and threats to biodiversity and food systems



References

ACB. 2018. GM mosquitoes in Burkina Faso. [Online] Available: https://www.acbio.org.za/sites/default/files/documents/GM_mosquitoes_in_Burkina_Faso_A_briefing_for_the_Parties_to_the_Cartagena_Protocol_on_Biosafety.pdf.

African Union (AU) and the New Partnership for Africa's Development (NEPAD). 2018. *Gene drives for malaria control and elimination in Africa.* [Online] Available: https://www.nepad.org/publication/gene-drives-malaria-control-and-elimination-africa.

Akbari Lab. 2021. *Inspiration*. [Online] Available: http://www.akbarilab.com/.

Anyanwu, E.C., Ehiri, J., Kanu, I. and Merrick, J. 2006. Health effects of long-term exposure to insecticide=treated mosquito nets in the control of malaria in endemic regions, revised. *The Scientific World Journal* 6:1630-41. DOI:10.1100/tsw.2006.272

Arrow, K.J., Panosian, C. and Gelband, H. (Eds). 2004. *Saving Lives, Buying Time: Economics of Malaria Drugs in an Age of Resistance.* [Online] Available: https://www.ncbi.nlm.nih.gov/books/NBK215638/.

Doshi, P. 2020. WHO's malaria vaccine study represents a "serious breach of international ethical standards". *BMJ* 368 doi: https://doi.org/10.1136/bmj.m734

Le Monde. 2021. Malaria: *"Why does the WHO recommend a vaccine that is only 30% effective?"*. [Online] Available: https://www.lemonde.fr/afrique/article/2021/11/17/paludisme-pourquoi-l-oms-recommande-t-elle-un-vaccin-efficace-a-seulement-30_6102427_3212.html.

Li, X., Zhou, H., Xu, J., Lin, Z. Sun, X. Li, J., Lin, X., Xie, Y., ALonso, P. and Yang, H. 2021. Seven decades towards malaria elimination in Yunnan, China. *Malaria Journal* 20:147. [Online] Available: https://link.springer.com/content/pdf/10.1186/s12936-021-03672-8.pdf.

Lindsay, S.W., Thomas, M.B. and Kleinschmidt, I. 2021. Threats to the effectiveness of insecticide-treated bednets for malaria control: thinking beyond insecticide resistance. *The Lancet* 9(9):E1325-E1331. DOI: https://doi.org/10.1016/S2214-109X(21)00216-3

Olotu, A., Fegan, G., Wambua, J., Nyangweso, G., Leach, A., Lievens, M., Kaslow, D., Njuguna, P., Marsh, K. & Bejon, P. 2016. Seven-Year Efficacy of RTS,S/AS01 Malaria Vaccine among Young African Children. *N Engl J Med*. 4(26):2519-29. DOI: 10.1056/NEJMoa1515257

Schreiber, M. and Gonzalez, L.L. 2020. *Rethinking the mosquito net.* Mail and Guardian. [Online] Available: https://mg.co.za/article/2020-02-28-rethinking-the-mosquito-net/#:~:text=Pyrethroids%20have%20historically%20been%20the,found%20in%20multiple%20research%20reviews.

Shretta, R., Liu, J. and Cotter, C., et al. 2017. Malaria Elimination and Eradication. In: Holme,s K.K., Bertozzi, S., Bloom, B.R. et al. (Eds). *Major Infectious Diseases.* 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank. Chapter 12. Available from: https://www.ncbi.nlm.nih.gov/books/NBK525190/ doi: 10.1596/978-1-4648-0524-0_ch12.

Sullivan, K. 2021. *First malaria vaccine a major milestone despite hurdles ahead.* [Online] Available: https://www.webmd.com/children/vaccines/news/20211202/malaria-vaccine-milestone-hurdles.

Weathers, P.J., Towler, M., Hassanali, A., Lutgen, P. and Engeu, P.O. 2014. Dried-leaf Artemisia annua: a practical malaria therapeutic for development countries? *World J Pharmacol* 3(4):39-55.

World Health Organization (WHO). 2021. *World Malaria report 2021*. [Online] Available: https://cdn.who.int/media/docs/default-source/malaria/world-malaria-reports/world-malaria-report-2021-regional-briefing-kit-eng.pdf?sfvrsn=338167b6_25&download=true.

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