

Available online at www.mchandaids.orgINTERNATIONAL JOURNAL of
MATERNAL and CHILD HEALTH and AIDS
ISSN: 2161-864X (Online)
ISSN: 2161-8674 (Print)
DOI: 10.21106/ijma.526**COMMENTARY | MALARIA****Malaria Elimination: What Can Africa Learn from China?****Claude Ngwayu Nkfusai, MSc^{1,2}; Olivia Ngou, MPH³; Caroline Ekoko Subi, MSc⁴; Sofia Mohlin, MSc³; Fidele Bemadoum, MPH³; Sylvanus Teboh, MSc⁵; Frankline Sevidzem Wirsy, PhD^{6,7,8}; Luchuo Engelbert Bain, PhD⁹**

¹Malaria Consortium, Buea, Cameroon; ²Department of Public Health, School of Nursing and Public Health, University of Kwa-Zulu Natal, Durban, South Africa; ³Impact Santé Afrique (ISA), Yaoundé, Cameroon; ⁴Local Youth Corner (LOYOC), Yaoundé, Cameroon; ⁵Saba University School of Medicine, Dutch Caribbean; ⁶Department of Epidemiology, College of Public Health, University of Nebraska Medical Center (UNMC), United States; ⁷GAPS, Cameroon; ⁸IntraHealth International, Suite 200 Chapel Hill, North Carolina, United States; ⁹International Institute of Rural Health, College of Social Science, University of Lincoln, Lincoln, United Kingdom

✉ **Corresponding author email:** ngwayuclaude1@gmail.com**ABSTRACT**

For decades now, malaria has been an important public health concern in Africa, which bears the greatest burden for the disease, affecting children and adults alike. Although a few countries (Australia, Brunei, Singapore, and Algeria, among others) have previously eliminated malaria, the World Health Organization (WHO), on June 30, 2021, declared China malaria-free. This commentary seeks to explore what China did differently to eliminate malaria and what Africa can learn from China's experience. First, Africa can use innovative tools and strategies used by China to attain success. Second, Africa can create a multi-sector collaboration among Heads of States in high burden malaria-affected countries by involving all stakeholders such as ministries of health, finance, research, education, development, public security, the army, police, commerce, industry, and information technology, customs, media and tourism to jointly fight malaria in all African countries. Furthermore, African countries could adapt the genetics-based approaches used by China in the elimination of mosquito breeding grounds. Finally, Africa can also adapt a better surveillance system of reporting on malaria daily as China did in their experience.

Keywords: • Africa • Learn • China • Elimination • Malaria • Health • sub-Saharan Africa

Copyright © 2022 Ngwayu Nkfusai et al. Published by Global Health and Education Projects, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution License **CC BY 4.0**.

I. Background and Introduction

Malaria is caused by a parasite of the genus *Plasmodium* and transmitted through the bite of a female *Anopheles* mosquito. Young children and pregnant women are the most vulnerable to the most serious consequences of malaria. Malaria is a serious disease with severe potential consequences, including death; however, treatment and prevention measures exist and have proven to be efficient. Although malaria is curable, approximately nine out of 10 malaria cases

resulted in deaths globally in 2015.¹ Africa bears a disproportionate burden of malaria with 94% of all cases and deaths globally in 2019.^{1,2} According to the World Health Organization (WHO) Malaria Report of 2021, 29 countries accounted for 96% of malaria cases globally, and six African countries – Nigeria (27%), the Democratic Republic of the Congo (12%), Uganda (5%), Mozambique (4%), Angola, (3.4%) and Burkina Faso (3.4%) – accounted for about 55% of all cases globally.³ By WHO sub-regions, West African

countries within the WHO African region had the highest prevalence of exposure to malaria during pregnancy (39.8%), closely followed by central Africa (39.4%), while prevalence was 22% in the east and southern Africa.³ Though Africa is the most affected continent with malaria cases, many countries on other continents have been carrying out relentless efforts to eliminate malaria in their countries, such as China.

For over 70 years, China has been carrying out relentless efforts to eradicate malaria from its territory. In the 1940s, China reportedly had 30 million cases annually. Over the decades, it accelerated the pace of progress towards elimination such that by 1990, malaria cases in China had declined to 117,000, and deaths had been reduced by 95%. With increased donor funds, within 10 years, the annual number of cases dropped to 5,000.³ In 2021, the World Health Organization awarded China a malaria-free certification making her the first country in the Western Pacific Region to be awarded this certification in more than 3 decades.³ Other countries that had previously received malaria-free certification include Australia (1981), Singapore (1982), and Brunei Darussalam (1987). In total, globally, 40 countries and territories have been granted a malaria-free certification from WHO, including, most recently, El Salvador (2021), Algeria (2019), Argentina (2019), Paraguay (2018), and Uzbekistan (2018).⁴

From our field experiences and scoping review, we established a mnemonic dubbed APCA²EK encapsulating our perspectives, shedding light on what China did differently to eliminate malaria and the lessons that Africa can learn from China in eliminating malaria. PCA²EK stands for P: **P**rovision of packages of free basic public health services, C: **C**reation of multi-sector collaboration, A: **A**pplication of new genetics-based approaches, A: **A**dherence to the 1-3-7 Respect of timeline, E: **E**limination of mosquito breeding grounds, and K: **K**eeping malaria at bay. To reach total malaria eradication, China had to think outside the box. China sought new and innovative approaches, which helped it to increase the pace at which it progressed towards the elimination of malaria. Its efforts/interventions in eradicating malaria have been impressive and are worth learning from the countries still struggling with the burden of

malaria. Below, we describe the different components and some interventions strategies within the PCA²EK framework which African nations can learn to advance their malaria elimination programs.

2.1. P=Provision of Packages of Free Basic Public Health Services

In its bid to eliminate malaria, the Chinese government provided basic public health care services to its population free of charge. There was no age restriction as both adults and children benefited from this free treatment of malaria regardless of their legal or financial status. This is not the case in most African countries, such as Cameroon, where malaria treatment is free only for children below 5 years old.⁴

2.2. C=Creation of a Multi-Sector Collaboration

The fight to eliminate malaria was not just the fight of the Ministry of Health. China adopted a model which involved multi-sectorial collaboration involving at least 13 ministries such as the Ministry of Finance, Ministry of Research, Ministry of Education Development, Ministry of Public Security, the Army, Police, Ministry of Commerce, Ministry of Industry and Information Technology, Customs, Media and Tourism jointly fought to end malaria nationwide.⁴ China understood that it was important to get all relevant departments and the whole society involved and to cooperate in order to achieve its malaria elimination goal. In most African countries, health issues are solely considered as the affair of the Ministry of Health and not treated as a common problem. Households, through cost recovery, finance part of “the construction of the health infrastructure, operating costs, the repurchase of pharmaceutical products, staff motivation, maintenance costs, and tool management.”

2.3. A=Application of New Genetics-Based Approaches

In its search for alternative solutions to malaria elimination, China developed innovative genetic-based approaches which helped to characterize malaria parasite populations. Malaria, which is caused by obligate intracellular parasites, faces an important decision of whether to continue

proliferation or invest in sexual transmission, which is a developmental dead-end if not ingested by a susceptible *Anopheles* mosquito. This stage makes for a promising point of transmission intervention, as very few parasites differentiate into gametocytes, and even fewer are permitted to develop in the vector. Targeting gametocytes will not only prevent the spread of malaria through the local community in Africa but also reduce the overall population disease burden in 33 moderate and high transmission countries in the WHO African Region, where there were an estimated 33.8 million pregnancies, of which 34% (11.6 million) were exposed to malaria infection.³ Historically, public health interventions that seek to disrupt mosquito transmission through environmental elimination or aim to limit human exposure to mosquito vectors have been very effective in reducing malaria prevalence in many but not all endemic regions if sustained.

In addition, China embarked on active surveillance of biomarkers that were related to drug resistance and categorizing parasitic cases into indigenous or imported, as well as identifying the sources of infections. With the ongoing rates of transmission in Africa, adapting and applying this strategy may change the rates of transmission in Africa.⁵ A therapeutic efficacy study would need to be carried out in several African countries. WHO recommends that therapeutic efficacy studies (TES) for 1st and 2nd line antimalarial medicines should be routinely carried out and data made available for decision-making due to the threat of emergence and spread of artemisinin resistance in malaria-endemic countries, especially in Africa.⁶

With support from the Harvard Global Institute, China formed an academic partnership to advance data-driven decision-making methods among researchers. The partnership drew researchers from the Chinese National Institute of Parasitic Diseases, the Chinese Center for Disease Control and Prevention, faculty from Harvard University and the Harvard T. H. Chan School of Public Health, and scientists from the Broad Institute of Massachusetts Institute of Technology and Harvard. By employing DNA sequencing and advanced genomic-based tools to understand and predict parasite movement and

to differentiate imported from indigenous parasites, this scientific partnership offered a road map for other countries seeking to control the disease across different elimination settings in Africa. China's efforts to partner with malaria-endemic countries like Lao People's Democratic Republic, Myanmar, and Vietnam to combat the disease have enabled meaningful connections in terms of providing guidance and support to control and eliminate malaria in Africa and other parts of the world.⁷

2.4. A=Adherence to the 1-3-7 Timeline

The 1-3-7 strategy that was initially developed and implemented in China in 2012 showed significant success on the road to malaria elimination. There is a need for this strategy to be adapted to the local contexts in several African country settings and strictly respect the timeline of the strategy over many years as China did. According to this strategy, "1" signifies the one-day deadline for health facilities to report a malaria diagnosis; "3" signifies that by the end of the 3rd day, health authorities are required to confirm a case and determine the risk of spread; and, the "7" signifies that within 7 days, appropriate measures must be taken to prevent further spread of the disease.⁴ In summary, the 1-3-7 surveillance and response model involves the investigation of malaria cases confirmed through rapid diagnostic testing (RDT) within three days and the application of targeted control measures to prevent further transmission within seven days. Furthermore, the reduction in annual parasite incidence (API) is attributable to the malaria control program efforts with support from the President's Malaria Initiative (PMI), the United States Agency for International Development (USAID), Global Fund and other non-programmatic factors.

2.5. E=Elimination of Mosquito Breeding Grounds

China made a major effort to reduce mosquito breeding grounds and stepped up the use of insecticide spraying in homes in some areas.⁸ China's government brought malaria cases down by using anti-malarial drugs, distributing insecticide-treated nets, and most importantly, spraying mosquito breeding grounds. Over the years, household spray applications had been

made, and arial larviciding was done. It also included drainage, removal of mosquito breeding sites, and spraying (occasionally from aircraft) of insecticides. Total elimination of transmission was slowly achieved in China.⁹ Africa needs to implement insecticide spraying (occasionally from aircraft) to disrupt open and hidden mosquito breeding grounds.

2.6. K=Keeping Malaria at Bay

The risk of imported cases of malaria was a major concern, particularly in southern Yunnan Province of China, which borders three malaria-endemic countries of Lao People's Democratic Republic, Myanmar, and Vietnam. China also faced the challenge of imported cases among Chinese nationals returning from sub-Saharan Africa and other malaria-endemic regions. In the WHO African Region, where there were an estimated 33.8 million pregnancies, of which 34% (11.6 million) were exposed to malaria infection, WHO and the RBM partnership to end malaria launched the high burden to high impact approach (HBHI) country-led approach as a mechanism to support the 11 highest-burden countries to get back on track to achieve the GTS 2025 milestones.² These 11 countries (Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, India, Mali, Mozambique, the Niger, Nigeria, Uganda, and the United Republic of Tanzania) accounted for 70% of the global estimated case burden and 71% of global estimated deaths.² To prevent the re-establishment of the disease, the country stepped up its malaria surveillance in endemic zones and has engaged actively in regional malaria control initiatives. Throughout the COVID-19 pandemic, China has maintained training for health care providers through an online platform and held virtual meetings for the exchange of information on malaria case investigations, among other topics.¹⁰

3. Conclusion and Global Health Implications

China's experience in achieving a malaria-free certificate from WHO is an extraordinary feat and gives hope to countries struggling with malaria endemicity. The question is, how can malaria-endemic countries in Africa learn from the Chinese experience? Africa carries the highest malaria burden

in the world, but which experiences from China could be implemented in African countries?

Firstly, by using innovative tools and strategies used by China to attain success. The product development pipeline for malaria was stronger, with promising new tools to detect, treat, and prevent malaria, including innovative diagnostics, medicines, vaccines, vector control products, and improved mechanisms for surveillance and response. Secondly, creating a multi-sector collaboration by Heads of States in high burden malaria-affected countries by involving all stakeholders, such as the different ministries and agencies, to jointly fight malaria in all African countries. Furthermore, African countries could explore the genetics-based approaches used by China and, more so, foster the elimination of mosquito breeding grounds. Lastly, Africa can implement a surveillance system of daily malaria case reporting as China did.

In summary, for Africa to eliminate malaria as China did, African governments and researchers should consider the following recommendations:

- Ensure that malaria eradication remains high on regional agendas with strong political commitment from leaders at all levels;
- Advocate at the global and country levels to ensure sufficient funding to protect our remarkable progress and end malaria in Africa for good;
- Support the introduction of new technologies that can accelerate the path to eradication of malaria in Africa;
- Understand the importance of strengthening the construction of the public health system, scientific and technological research in eliminating malaria and consolidating achievements;
- Make progress in global malaria elimination and challenges despite COVID-19;
- Apply genetic methods to the technical support of eliminating malaria and improving public health;
- Strengthen cooperation with other African countries in malaria control and research;
- Internal efforts to develop drugs to replace resistant ones;
- Give free access to treatment for all and effective surveillance; and

- Reinforce community engagement capacities of local community leaders by educating the communities on malaria prevention and control measures.

Compliance with Ethical Standards

Conflicts of Interest: The authors declare that they have no competing interests. **Financial Disclosure:** Nothing to Declare.

Funding/Support: There was no funding for this study.

Ethics Approval: Not applicable. **Acknowledgments:** We are grateful to the authors who participated in this paper. **Disclaimer:** The authors are responsible for the views expressed in this article, which do not necessarily, represent the views, decisions, or policies of the institutions with which they are affiliated.

Key Messages

- ▶ Africa can use innovative tools and strategies used by China to attain success in malaria elimination.
- ▶ Africa can create a multi-sector collaboration among Heads of States in high burden malaria-affected countries by involving all stakeholders to jointly fight malaria in all African countries.
- ▶ African countries can adapt the genetics-based approaches used by China in the elimination of mosquito breeding grounds.

References

1. World Health Organization. *Global Technical Strategy for Malaria 2016-2030*. World Health Organization; 2015. Accessed February 25, 2022. <https://www.who.int/publications/i/item/9789240031357>
2. Maharaj R, Kissoon S, Lakan V, Kheswa N. Rolling back malaria in Africa—challenges and opportunities to winning the elimination battle. *S Afr Med J*. 2019;109(11b):53-56. doi: 10.7196/SAMJ.2019.v109i11b.14250
3. World Health Organization. *World Malaria Report 2021*. World Health Organization; 2021. Accessed February 26, 2022. <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2021>
4. Zhou XN. China declared malaria-free: a milestone in the world malaria eradication and Chinese public health. *Infect Dis Poverty*. 2021;10(1):98. doi: 10.1186/s40249-021-00882-9
5. Chen, JH., Fen, J. & Zhou, XN. From 30 million to zero malaria cases in China: lessons learned for China–Africa collaboration in malaria elimination. *Infect Dis Poverty*. 2021;10(1):51. doi: 10.1186/s40249-021-00839-y
6. Mwakangalu D. Malaria Therapeutic Efficacy Study (TES) Kenya (Kenya-TES). National Library of Medicine. Clinical Trials.gov. Published February 23, 2021. Accessed April 5, 2022. <https://clinicaltrials.gov/ct2/show/NCT04767191>
7. Achan J, Mwesigwa J, Edwin C, D'alessandro U. Malaria medicines to address drug resistance and support malaria elimination efforts. *Expert Rev Clin Pharmacol*. 2018;11(1):61-70. doi: 10.1080/17512433.2018.1387773
8. Rozendaal JA. *Vector Control: Methods for Use by Individuals and Communities*. World Health Organization; 1997. Accessed December 15, 2021. <https://apps.who.int/iris/handle/10665/41968>
9. Price-Smith A. *The Health of Nations Infectious Disease, Environmental Change, and Their Effects on National Security and Development*. The MIT Press; 2021. Accessed March 18, 2022. <https://assets.pubpub.org/az6e8alq/11587654873115.pdf>
10. World Health Organization. *WHO Malaria Policy Advisory Group (MPAG) Meeting Report (April 2021)*. World Health Organization. Published May 21, 2021. Accessed April 9, 2022. <https://www.who.int/publications/i/item/9789240027350>

PUBLISH IN THE INTERNATIONAL JOURNAL of Maternal and Child Health and AIDS



- Led By Researchers for Researchers
- Immediate, Free Online Access
- Authors Retain Copyright
- Compliance with Open-Access Mandates
- Rigorous, Helpful, Expeditious Peer-Reviews
- Highly Abstracted and Indexed
- Targeted Social Media, Email Marketing

www.mchandaids.org