12-2023

China's Hidden Role in Malaria Control and Elimination in Africa

Julius Nyerere Odhiambo
William & Mary

Carrie B. Dolan
William & Mary, cbdolan@wm.edu

Ammar A. Malik
William & Mary

Aaron Tavel
William & Mary

Recommended Citation

Odhiambo, Julius Nyerere; Dolan, Carrie B.; Malik, Ammar A.; and Tavel, Aaron, China's Hidden Role in Malaria Control and Elimination in Africa (2023). *BMJ Global Health*, 8.
https://www.doi.org/10.1136/bmjgh-2023-013349

BMJ Global Health

China's hidden role in malaria control and elimination in Africa

Julius Nyerere Odhiambo ,[1,2] Carrie Dolan ,[1,2] Ammar A Malik,[3] Aaron Tavel[2]

To cite: Odhiambo JN, Dolan C, Malik AA, *et al*. China's hidden role in malaria control and elimination in Africa. *BMJ Glob Health* 2023;**8**:e013349. doi:10.1136/bmjgh-2023-013349

Handling editor Valery Ridde

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjgh-2023-013349).

Received 7 July 2023
Accepted 15 November 2023

[1]Department of Kinesiology and Health Sciences, William & Mary, Williamsburg, Virginia, USA
[2]Ignite Global Health Research Lab, Global Research Institute, William & Mary, Williamsburg, Virginia, USA
[3]AidData, Global Research Institute, William & Mary, Williamsburg, Virginia, USA

Correspondence to
Dr Julius Nyerere Odhiambo; jnodhiambo@wm.edu

ABSTRACT

Background Insufficient funding is hindering the achievement of malaria elimination targets in Africa, despite the pressing need for increased investment in malaria control. While Western donors attribute their inaction to financial constraints, the global health community has limited knowledge of China's expanding role in malaria prevention. This knowledge gap arises from the fact that China does not consistently report its foreign development assistance activities to established aid transparency initiatives. Our work focuses on identifying Chinese-funded malaria control projects throughout Africa and linking them to official data on malaria prevalence. By doing so, we aim to shed light on China's contributions to malaria control efforts, analysing their investments and assessing their impact. This would provide valuable insights into the development of effective financing mechanisms for future malaria control in Africa.

Methods Our research used AidData' s recently released Global Chinese Development Finance Dataset V.2.0 providing comprehensive coverage of all official sector Chinese development financing across Africa, from which we identify 224 Chinese-funded malaria projects in Sub-Saharan Africa (SSA) committed between 2002 and 2017. We conducted an analysis of the spending patterns by year, country and regions within Africa and compared it with data on population-adjusted malaria prevalence, sourced from the Malaria Atlas Project.

Results Chinese-financed malaria projects Africa mainly focused on three areas: the provision of medical supplies (72.32%), the construction of basic health infrastructure (17.86%) and the deployment of anti-malaria experts (3.57%). Moreover, nearly 39% of the initiatives were concentrated in just four countries: the Democratic Republic of Congo, Central African Republic, Uganda and Liberia. Additionally, China's development financing amount showed a weak negative correlation (−0.2393) with population-weighted malaria prevalence. We concluded that the extent and direction of China's support are not adequately tailored to address malaria challenges in different countries.

Conclusion With China's increasing engagement in global health, it is anticipated that malaria control will continue to be a prominent priority on its development assistance agenda. This is attributed to China's vast expertise in malaria elimination, coupled with its substantial contribution as a major producer of malaria diagnostics and treatments.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The motivations behind China's allocation of malaria aid to Africa remain complex due to limited information on the details of malaria aid project activities.

WHAT THIS STUDY ADDS

⇒ We shed light on China's contributions to malaria control efforts and better understand the impact of their interventions.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ There are promising opportunities for collaboration and valuable insights to be derived from China's successful endeavours in malaria elimination.

⇒ By harnessing the cooperation between China and Western donors, there is the potential to attain sustainable malaria control and elimination milestones across Africa.

INTRODUCTION

Since 2000, significant strides have been made globally in combatting malaria, resulting in a reduction of approximately 1.9 million cases and 14 000 deaths each year.[1] These achievements were supported by increased funding from various partners, including the World Health Organization (WHO), the USA President's Malaria Initiative, the Global Fund and the Bill and Melinda Gates Foundation.[2–4] However, despite these efforts, access to essential tools for malaria prevention and treatment remains limited, particularly in Africa, which accounted for around 95% of reported malaria cases and 96% of deaths in 2021.[5] The effectiveness of primary malaria interventions has declined, while drug resistance and insecticide-treated net resistance have risen.[6 7] Additionally, malaria control efforts place a significant financial burden on national budgets, with countries allocating a considerable proportion of their already limited healthcare funds towards malaria control.[8 9]

Concerningly, the funding gap for malaria control and elimination stood at USD $2.6 billion in 2019, and by 2021, it had increased to

USD $3.8 billion.[5] The total investment in malaria control and elimination for 2021 amounted to US$3.5 billion, falling short of the required US$7.3 billion needed to achieve the Global Technical Strategy (GTS) milestones of reducing malaria incidence and mortality by at least 75% by 2025 and 90% by 2030.[10] The widening funding gap signals a growing challenge in meeting the financial requirements for effective malaria control strategies.[11]

Most recently, insufficient funding at international and domestic levels has created significant gaps in accessing proven malaria control tools, posing a substantial threat to vulnerable populations.[12] This shortfall has largely been driven by the global response to the COVID-19 pandemic, diverting resources away from malaria and other health priorities.[13] Consequently, funding from international organisations, private sector entities and developed countries has decreased, hampering the ability of researchers and public health officials to innovate in malaria prevention, treatment and control. This situation is particularly alarming considering the persistently high malaria burden in many parts of Africa and other regions, where access to effective interventions remains limited and over 600 000 people still die annually from malaria.[14 15]

The erosion of previous progress in malaria control has impeded efforts towards elimination, leading to the scaling back of crucial activities for prevention, diagnosis and treatment.[16] Countries like Ghana, Ivory Coast and Comoros have been compelled to defer essential malaria interventions, including insecticide-treated bed nets (ITNs) and indoor residual spraying (IRS), which have been critical for decades.[15 16] According to a modelling study, the disruption of primary malaria control interventions, such as campaigns distributing ITNs, is estimated to result in reduced coverage and an increase in malaria cases, leading to higher incidence and mortality rates.[17]

The disruptions in malaria funding underscore the need to review the global health financing architecture to secure the gains already achieved.[18] Presently, global malaria control and elimination programmes heavily rely on a limited number of major funders who may be unwilling to augment their contributions to tackle emerging challenges such as urban malaria and antimalarial drug resistance.[19] To achieve the targets intrinsically linked to most of the Sustainable Development Goals (SDGs) by 2030, it is imperative to explore the potential involvement of non-traditional donors such as China in malaria control and elimination endeavours.

China's remarkable achievements in meeting global health targets for diseases such as tuberculosis (TB), lymphatic filariasis, schistosomiasis and malaria provide valuable insights and credibility for African nations. These accomplishments have been made possible by significant technological advancements, including the development of vaccines and therapeutics, resulting in international recognition of China's leading malaria scholars.[20] Additionally, China plays a crucial role as a prominent manufacturer of diagnostic reagents and essential medications.[21] Through its health diplomacy efforts, notably the Health Silk Road, China has established a platform for sharing crucial health commodities with numerous countries.[22] Disease prevention, policy development, health promotion and capacity building have been prioritised by China in its health diplomacy initiatives.[23]

As Africa's largest trading partner and investor, China has taken independent initiatives to provide resources and actively collaborate with other bilateral donors and multilateral agencies to enhance healthcare systems in Africa.[24 25] In 2000, China established the Forum on China-Africa Cooperation (FOCAC) with the aim of promoting trade, investments, infrastructure development and capacity building between China and Africa. Within this framework, the ministerial subforum on China-Africa Health Cooperation has played a leading role in malaria control efforts on the continent. Notably, the initiative implemented mass drug administration in Comoros, resulting in a significant 95% reduction in malaria incidence. Additionally, in partnership with the United Kingdom, China has worked in Tanzania to develop a locally tailored approach for reporting malaria cases in endemic villages.[26 27]

Although China plays a significant role in developing diagnostic and therapeutic interventions for malaria, the full extent of its impact on malaria control and its underlying motivations for investment have not been comprehensively documented. The complexity arises from the use of diverse financing instruments and involvement of multiple actors, making it challenging to assess the complete scale and scope of China's contributions. Moreover, China's lack of transparent reporting of financial flows through international channels such as the Organisation for Economic Co-operation and Development (OECD)'s Creditor Reporting System (OECD-CRS) or the International Aid Transparency Initiative contributes to the secrecy surrounding its development efforts.[28] Furthermore, there is a misunderstanding or oversight regarding China's operational definition of development assistance in health, which differs significantly from the conventional definition of official development assistance. This discrepancy limits the exploration and comparison of China's contributions.[29 30] To enhance transparency in its official development assistance reporting, China established the International Development Cooperation Agency (CIDCA) in 2018, which aims to elevate the political significance of its foreign aid.[31] Despite these efforts, the precise amount of China's expenditure on disease-specific initiatives like malaria control remains unclear, and there is a scarcity of documented evidence regarding their involvement in such programmes.

The GTS for malaria aims to achieve its milestones by 2030 through an annual investment of US$6.6 billion.[32] However, with limited anticipated growth in conventional funding sources, it becomes imperative to assess China's expenditure on malaria. This research will provide valuable insights for developing efficient

financing mechanisms for ongoing and prospective malaria control endeavours. The international community can glean several implications from China's investment in African malaria control. Additionally, China's involvement underscores the promise of South–South cooperation, where mutual collaboration among developing countries can lead to significant benefits. Such engagement might inspire emerging economies like India, Brazil and South Africa to follow suit. A notable shift is observed in the funding landscape as China's emergence as a major donor reduces dependence on Western and traditional funding sources, paving the way for more robust and sustainable financial mechanisms. Furthermore, Chinese pharmaceutical investments open the door to joint research endeavours, enabling Western entities to align with Chinese counterparts to exchange knowledge, resources and technology. This partnership indicates a need to rethink prevalent aid models. China's comprehensive approach, intertwining direct financing with capacity enhancement and infrastructural growth, challenges traditional donors to reassess and possibly adapt their methods for amplified outcomes. However, it is crucial to recognise the political and diplomatic nuances embedded in China's contributions. Their investments transcend mere benevolence, demanding a nuanced understanding from the global community when discussing health-centric collaborations in Africa.

METHODS

Chinese investments

We used the AidData's Global Chinese Development Finance (GCDF) Dataset V.2.0 to extract data on Chinese investments in malaria. This data set, which is publicly available, addresses a significant gap in the reporting of global aid flows. Despite being the largest provider of official sector development financing globally and Africa's biggest trading partner, China does not have a systematic reporting mechanism for its financing activities.[33] This lack of information creates significant challenges for host countries and development partners in effectively allocating resources without knowledge of the timing, location and nature of China's contributions. To overcome this challenge, AidData developed the GCDF Dataset, which includes information on 13 427 Chinese foreign assistance projects worldwide between 2000 and 2017.[34] The GCDF is a comprehensive and detailed data set that covers projects in low and middle-income countries across various sectors according to international aid transparency standards. It provides 70 parameters, including information on stakeholders involved, spatial and temporal characteristics of key project milestones, and in-depth descriptions of the projects spanning from inception to completion in 140 words. For a subset of 3285 projects across 138 countries, AidData provides precise geolocations, with many of these projects focusing on public infrastructure such as hospitals, clinics and pharmacies. By following the OECD-CRS guidelines that define sectors with three-digit codes (eg, 120 for Health), flow types (ie, aid or loans) and other project details (eg, lending terms), it enables apples-to-apples comparisons between Chinese and Western aid agencies' allocations (online supplemental table 1). But because AidData does not provide five-digit subsectoral codes needed to understand the purpose of each health aid project, we undertook manual coding using the OECD-CRS sector guidelines.[35] We did this through a double-blind review process, whereby two researchers independently hand-coded all health sector projects, and all disagreements were arbitrated by the lead researcher through in-person reviews to make final determinations.

The final data set was reviewed for relevance and organised at the project location level. The variables in the data set included the precise project location (ie, latitude and longitude), commitment year, sector and the total amount of aid pledged (if available). We extracted 224 malaria-specific investments in 36 countries covering commitment years 2000–2017. We then aligned the financial flows to matching OECD's Creditor Reporting System (CRS) as of April 2022 (table 2).

Given that China's CIDCA or other authorities do not systematically report on their overseas development programming activities, this is the next best approach to developing a comprehensive understanding of the true scope and scale of China's health interventions in Africa.

Malaria prevalence data

Modelled estimates for malaria prevalence caused by *Plasmodium falciparum* (dominant strain in SSA) were sourced from the Malaria Atlas Project. The Project uses the Bayesian space-time geostatistical approach, which incorporates geospatial, environmental and socio-economic covariates in quantifying the malaria burden.[36]

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this study.

RESULTS

Allocation of malaria development assistance across countries and regions

A total of 224 projects were geolocated in different countries, with many of the projects having been committed before 2008. Overall, the commitment amounts by China had a weak negative correlation (−0.2393) with the population-weighted malaria incidence. China's malaria aid was primarily directed towards four countries, namely the Democratic Republic of Congo, Central African Republic, Uganda and Liberia. In contrast, Malawi, Guinea Bissau and Sao Tome and Principe received the least number of investments. Regionally, most of the assistance was provided to West African countries, with China funding 87 projects, accounting for 38.84% of the total. East African countries were the second-highest beneficiaries, with 64 projects (28.57%), followed by Central

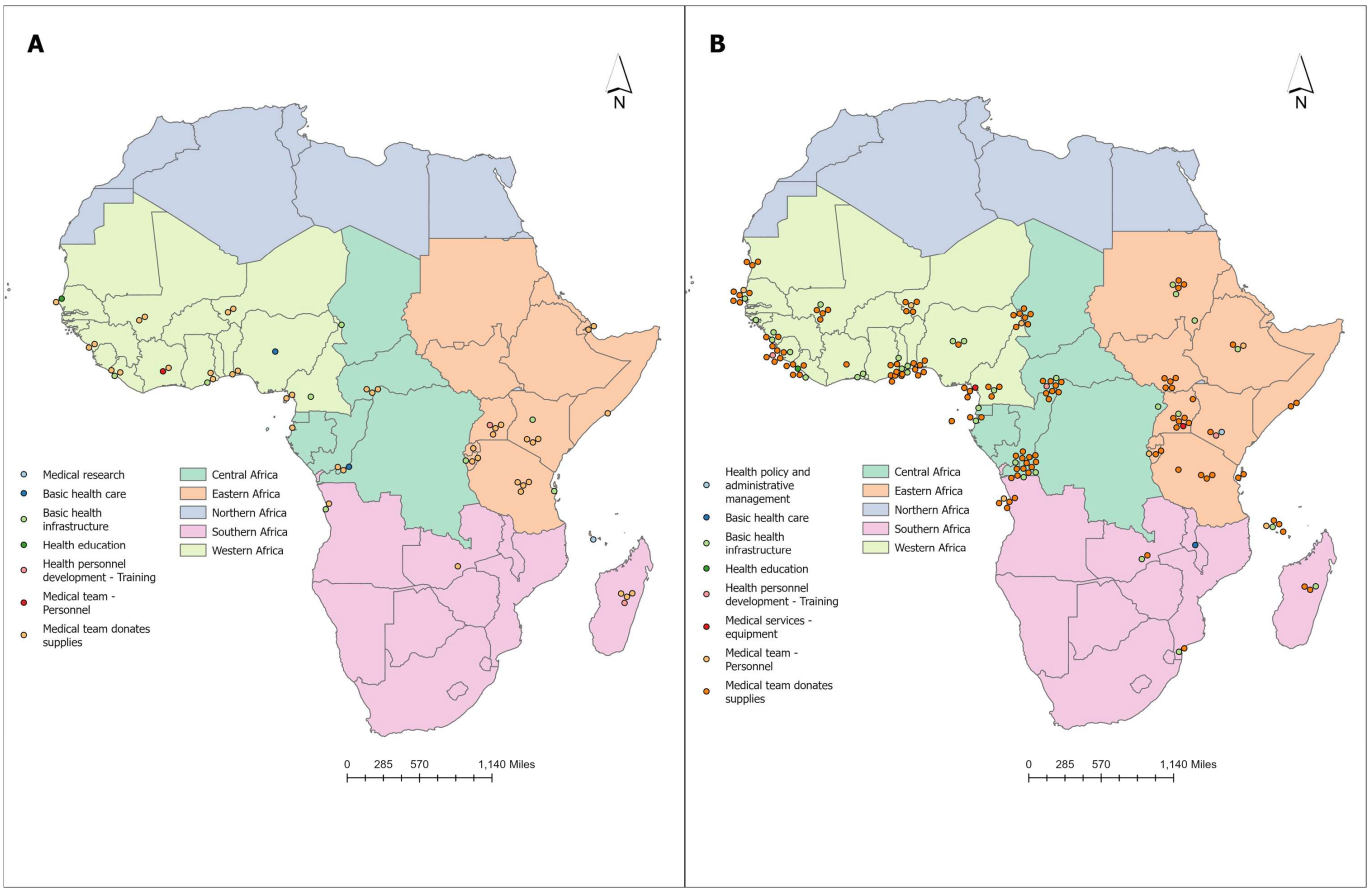

Figure 1 Spatial distribution of Chinese malaria projects/awards by country in SSA. SSA, Sub-Saharan Africa.

Africa with 53 projects (23.66%), and Southern Africa with 20 projects (8.93%), as illustrated in figure 1.

Assessing the extent of China's contributions towards malaria in specific settings is crucial for implementing effective control measures. Table 1 presents a summary of the total reported malaria assistance and its variation across regions and countries between 2002 and 2017. The table ranks each region based on the total number of awards it received. Our findings reveal significant variations in malaria development assistance patterns over time, with most of the malaria spending directed towards countries located in the Western African region.

Between 2002 and 2009, there was a sudden rise in malaria development assistance in 2006. However, from 2009 to 2016, there was a significant decline in malaria assistance. By 2017, malaria assistance accounted for approximately US$19.1 million (28.5%) of the reported total development assistance, as illustrated in figure 2.

Chinese assistance and malaria endemicity

Figure 3 depicts the relative priority given by China to African geopolitical regions between 2002 and 2009. It is worth noting that the Southern African region, which had the lowest malaria prevalence, also had the lowest number of projects. Across the continent, the total number of Chinese projects increased as the prevalence of malaria decreased. Similarly, as the malaria prevalence continued to decline after 2009, the number of Chinese projects also decreased.

Table 1 Chinese development assistance by Africa's geopolitical regions

Region	Projects			Total amount reported (US $)	Allocation of projects with financial details (%)
	Total number of projects (N, %)	Financing details missing (N, %)	Financing details reported (N, %)		
West Africa	87 (38.84)	44 (35.2)	43 (43.43)	42 800 000	63.88
East Africa	64 (28.57)	37 (29.6)	27 (27.27)	1,3700,000	20.45
Central Africa	53 (23.66)	32 (25.6)	21 (21.21)	7 957 269	11.88
Southern Africa	20 (8.93)	12 (9.6)	8 (8.08)	250,0164	3.73

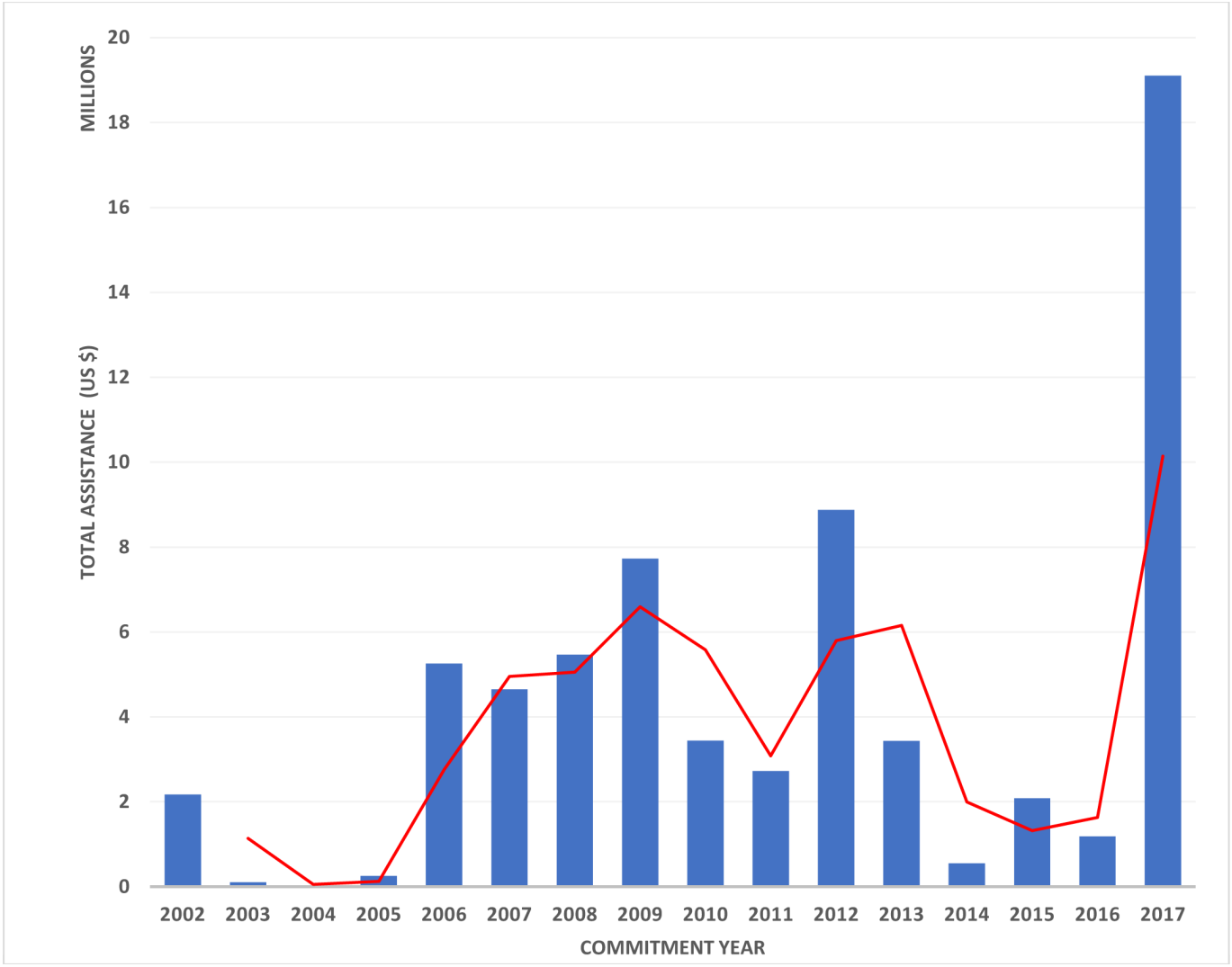

Figure 2 China malaria assistance over time with a 2-year moving average trend-line.

Malaria spending categories

Table 2 provides an overview of the malaria spending categories, indicating the areas that received the most aid. The largest share of malaria aid (72.32%) went to medical teams consisting of anti-malaria experts from China as well as medical supplies like anti-malaria medicines and insecticide-treated nets. This indicates that China's approach to malaria control involves providing not only financial support but also personnel and resources to help build local capacity in affected countries. The Western African region received the highest number of medical teams, with 64 teams (37.65%). This was followed by Eastern Africa with 49 teams (28.82%), Central Africa with 43 teams (25.29%) and Southern Africa with 14 teams (8.24%). This distribution may reflect the differences in malaria burden and control strategies in different regions. At the country level, the Democratic Republic of Congo, Central African Republic and Uganda had the highest number of medical teams from China. These countries may have been prioritised due to their high malaria burden and limited resources for control measures.

China implemented 40 basic healthcare infrastructure projects to combat malaria, which were mainly accomplished through providing funds and grants for the construction of anti-malaria centres that were also equipped with related diagnostic and treatment facilities. The West African region had the highest number of projects with 19 (47.50%), followed by the East African region with 10 basic health infrastructure projects (25.00%). Sudan and Togo had the highest number of projects by country. In addition, China also trained medical personnel on malaria control and prevention through five awards (2.23%). Other forms of aid included basic healthcare (1.34%), medical services (0.89%), health education (0.45%), research (0.45%) and health policy and administrative management (0.45%).

DISCUSSION

The WHO has set ambitious targets to reduce malaria burden by 90% and subsequently eliminate it in at least 35 countries by 2030.[10] However, the current state of malaria control is facing challenges such as inadequate

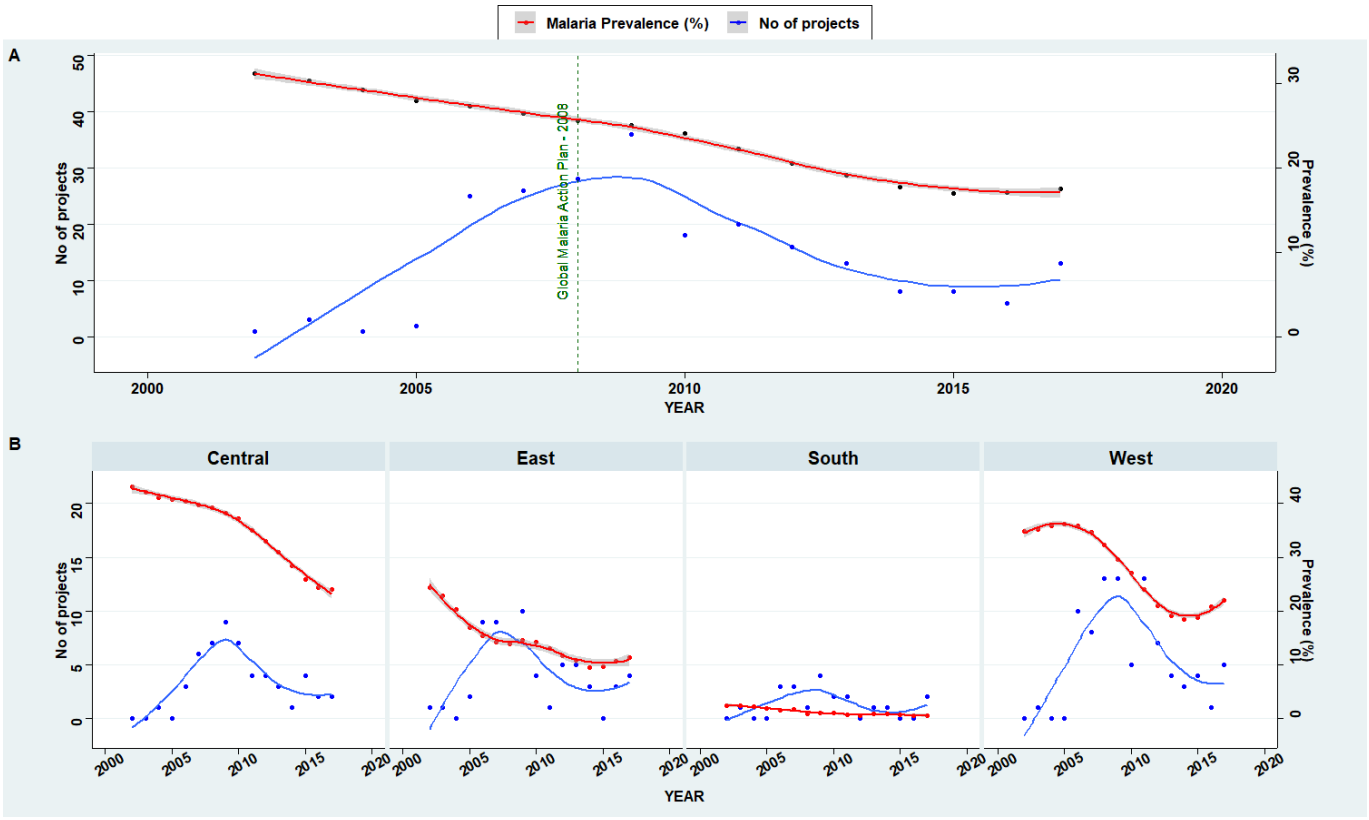

Figure 3 Temporal distribution of malaria assistance and clinical burden (A). The blue and red lines represent the number of Chinese development assistance projects and the population-adjusted mean malaria prevalence, respectively, in SSA (2000–2017). This distribution was fit using the locally weighted scatterplot smoothing approach, with the shading on the red line indicating a 95% uncertainty interval. (B) This has been stratified according to the different geopolitical zones in Africa. SSA, Sub-Saharan Africa.

Table 2 Purpose of Chinese malaria development assistance in SSA (2000–2017)

Code	Purpose	Number of awards	Proportion of total awards (%)
12110	Health policy and administrative management	1	0.45
12182	Medical research	1	0.45
12220	Basic health care	3	1.34
12230	Basic health infrastructure	40	17.86
12262	Malaria control	1	0.45
12261	Health education	1	0.45
12281	Health personnel development—training	5	2.23
121912	Medical services—equipment	2	0.89
122201	Medical team—personnel	8	3.57
122202	Medical team donates supplies	162	72.32

SSA, Sub-Saharan Africa.

funding, poor health infrastructure, the emergence of parasites resistant to the available anti-malaria drugs. The COVID-19 pandemic has further strained access to malaria services with resources being redirected to combat COVID-19.[37] As a result, the development assistance landscape continues to evolve in purpose, quantity and modalities to mirror the ongoing shifts in the identities of both aid donors and recipient countries.

Meanwhile, China's efforts in Africa continue to gain traction and have further been bolstered by multiple innovations and domestic success in its malaria control and elimination.[38] The discovery of artemisinin by Tu Youyou has had a profound impact on the well-being of vulnerable populations, particularly pregnant women, and children under the age of 5.[20] The implementation of the '1-3-7' surveillance timeline, which entailed notifying cases within 1 day, conducting case investigations within 3 days, and carrying out foci investigations and targeted actions within 7 days, has been successfully incorporated in malaria endemic countries in Africa.[39] Academic partnerships have been instrumental in cultivating a strong health community between China and Africa. To strengthen their efforts in combating malaria, countries such as Burkina Faso, Cameroon, Sierra Leone, Cote d'Ivoire, Tanzania and Zambia have signed agreements aimed at establishing institutional

partnerships.[39 40] These collaborations focus on capacity building and the exchange of knowledge, encompassing the implementation of innovative genomic-based tools to disrupt mosquito transmission and active surveillance of drug resistance biomarkers to inform efforts towards malaria control and elimination.[22]

While China's domestic approach to malaria control and elimination has been widely lauded, its approach to health aid in Africa continue to face substantial criticism despite its long history of deploying foreign aid as an indispensable component of its foreign policy.[41 42] First concerns have been raised over its intentions/China use of malaria aid as a geopolitical tool, with some studies focusing on what China gets out of these partnerships.[43] Its priority in politically fragile jurisdictions with weak infrastructure and regulatory frameworks raises concerns over its political and economic motives.[44] China's motivations are believed to stem from its desire to secure access to raw materials, boost its exports and establish stronger business connections with recipient nations. While recipient countries generally express gratitude for China's healthcare assistance, there are instances where concerns have been raised regarding the extent of China's involvement, its exploitation of natural resources and its impact on African trade markets.[45 46] These circumstances present intricate challenges that encompass epidemiological, political and socioeconomic factors, all of which influence malaria control efforts.

Second, China has not fully embraced the Paris Declaration on Aid Effectiveness, and its commitment to the Busan Partnership for Effective Development Cooperation has been uncertain, despite its increasing ambition to play a more pivotal role in global health governance.[42 47] This has raised concerns over China's ability to transparently channel its health aid to countries based on their malaria burden. Our analysis reveals significant variations in the allocation rationale of Chinese malaria aid across different regions and countries between 2002 and 2009. During this time frame, countries such as the Central African Republic and the Democratic Republic of Congo received substantial levels of assistance and investment in comparison to other African nations.[39 48] Surprisingly, Nigeria, which bears the highest burden of malaria cases and deaths in West Africa, received a disproportionally lower amount of aid relative to its malaria burden. It is important to note that resource allocation in Nigeria's malaria control efforts is influenced by a multitude of factors specific to its context, including the need to maximise the effectiveness of interventions across diverse regions and populations, and the evolving landscape of malaria aid, including contributions from China. During the 2006 FOCAC Beijing Declaration, the Chinese government pledged to establish 30 anti-malaria centres and provide anti-malaria drugs in Africa over the following 3 years (from 2006 to 2009). The subsequent decline in aid levels from 2009 can be attributed to the successful completion of these 30 anti-malaria centres. Questions remain on the long-term sustainability and impact of these centres.[49]

Despite the 2008 call of the Global Malaria Action Plan for sustained investments,[50] our findings also reveal a gradual decline in China's direct involvement in malaria control in subsequent years. This decline occurred despite the growing need for increased funding to expand crucial interventions like insecticide-treated nets, IRS, diagnostics, and therapeutics to global targets.

In the 2001 Abuja declaration, many countries pledged to allocate at least 15% of their annual budget to improve their health sector and urged donor countries to increase support.[51] In responding to this call, China has employed a diverse set financing instruments and continues to engage with multiple in-country stakeholders to support a consistent set of priority interventions. These include dispatching malaria experts and medical teams to designated countries, building healthcare infrastructure, supplying antimalarial drugs and diagnostic equipment. China demonstrates its long-term commitment to building sustainable capacity for malaria control by training health personnel. Its establishment of essential health infrastructure and malaria centres plays a crucial role in advancing the SDGs, specifically SDG 3 on health and well-being, and SDG 17 on partnerships for the goals. Overall, our analyses show the potential of China to support various priority interventions in Africa, including mass administration of insecticide-treated nets, reducing maternal and neonatal infection consequences during pregnancy, replacing failing drugs with artemisinin-based combination therapy, enhancing diagnostic capabilities at point-of-care with rapid tests and improving surveillance and vital registration systems. These interventions were not accessible during the Global Malaria Eradication Programme, presenting new opportunities for revised objectives that align with the local priorities and strategies for its malaria aid efforts.

Limitations

Our analyses combine existing data on the geographical distribution of malaria prevalence and malaria aid projects with new data on infrastructure projects awarded to Chinese firms. This comprehensive data set includes detailed information such as the number and value of projects, precise geographic locations, sectors involved and contracting firms. However, despite these valuable data sources, fully understanding the connection between Chinese spending on malaria control and the resulting decrease in malaria burden is challenging due to several factors. These include the existence of diverse epidemiological factors, the variability of political and socioeconomic conditions across different countries and the concurrent implementation of other interventions from other donors that contribute to the overall malaria control efforts. The complexity of China's financing mechanisms and the involvement of multiple actors further complicate the assessment of the extent of Chinese assistance for malaria control.

Moreover, our research reveals significant gaps in Chinese malaria spending data, impeding projections

of future spending and evaluations of the impact of its investments subnationally. In some cases, the definition of malaria-specific spending and the available input data may exhibit contradictions and incomplete documentation in project descriptions. Evaluating the value of in-kind malaria assistance provided by Chinese provincial governments in different countries is also a difficult task. While the analysis focuses on projects directly targeting malaria control, it is worth noting that other projects in sectors such as transport infrastructure or industry may indirectly contribute to malaria control efforts.

Overall, an exhaustive understanding of China's malaria aid requires careful consideration of these complexities, limitations in development data and a careful appraisal of its multiple actors to accurately assess the extent of Chinese assistance and its contribution to malaria control efforts. Therefore, it is essential to consider our findings and interpretations in the context of this inherent limitation. We acknowledged that our data set may not encompass the complete spectrum of China's contributions to malaria control in Africa. Nonetheless, it is noteworthy that our data set offers an unparalleled level of detail and comprehensiveness regarding Chinese overseas development finance. This serves to address a crucial data gap and presents invaluable insights that can benefit researchers, policymakers, and funding entities alike.

CONCLUSION

As China's involvement in global health expands, malaria control is expected to remain focal on its development agenda. This is driven by China's rich experience in successfully eradicating malaria within its borders and its significant contribution as a major manufacturer of malaria diagnostics and treatments in a competitive setting of global pharmaceutical production and distribution. Despite its rich history and growing commitment to the malaria control and elimination initiative in Africa, there still exists a gap in the overall understanding of the full scope and magnitude of China's engagement in malaria control and elimination efforts across different epidemiological settings. This entails highlighting fruitful partnerships, quantifying contributions and scrutinising collaborations with international organisations like the WHO and the Global Fund to Fight AIDS, Tuberculosis and Malaria. There is still need to better understand China's proactive investment channels and portfolios in the context of global health security, address existential challenges and explore innovative strategies by identifying obstacles that China faces in-country in its malaria control efforts. This broader context would enhance our understanding of China's global role in malaria control.

In the era of limited resources, conducting disease-specific resource tracking studies is essential to drive sustained investment in global health. It serves as a crucial mechanism for efficiently allocating resources to combat communicable diseases such as malaria, which remains a threat in many countries in Africa. Our study highlights the need for China to maintain transparency in accounting for its health and development-related activities. This transparency contributes to more responsive and adaptive programmes and enables policymakers in African countries to better track and assess the impact of donor-financed initiatives. Enhanced transparency in financing initiatives enhances trust among donors and recipient countries, ultimately benefiting global malaria control efforts.

We underscore the importance of conducting disease-specific resource tracking studies. Such studies are not only practical for improving global health outcomes but also essential for aligning investment decisions with the specific needs and demands of malaria control initiatives. This directly contributes to SDG goal 3 objective of better health and well-being and reinforce the spirit of goal 17 by fostering partnerships and cooperation to address malaria and broader global health objectives. In essence, these initiatives are instrumental in driving sustained investments in global health resource allocation.

Contributors JNO, CB and AAM conceived and designed the study. JNO, AT curated the data and did the formal analysis. JNO wrote the first draft of the manuscript. JNO, CB, AAM revised the draft critically for important intellectual content. All authors read and approved the final version of the manuscript. JNO is the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. Data are available in a public, open access repository at https://www.aiddata.org/datasets for Chinese Development Finance Dataset and https://malariaatlas.org/ for malaria prevalence estimates.

ORCID iDs

Julius Nyerere Odhiambo http://orcid.org/0000-0002-9817-1849
Carrie Dolan http://orcid.org/0000-0002-4445-7075

REFERENCES

1 Global Burden of Disease Collaborative Network. Global malaria spending 2000-2017; 2020.

2 Gething PW, Smith DL, Patil AP, *et al*. Climate change and the global malaria recession. *Nature* 2010;465:342–5.
3 Gething PW, Casey DC, Weiss DJ, *et al*. Mapping Plasmodium Falciparum mortality in Africa between 1990 and 2015. *N Engl J Med* 2016;375:2435–45.
4 Chang AY, Cowling K, Micah AE, *et al*. Past, present, and future of global health financing: a review of development assistance, government, out-of-pocket, and other private spending on health for 195 countries, 1995–2050. *The Lancet* 2019;393:2233–60.
5 World malaria report 2022. World Health Organization; 2022.
6 Conrad MD, Rosenthal PJ. Antimalarial drug resistance in Africa: the calm before the storm? *Lancet Infect Dis* 2019;19:e338–51.
7 Ippolito MM, Moser KA, Kabuya J-BB, *et al*. Antimalarial drug resistance and implications for the WHO global technical strategy. *Curr Epidemiol Rep* 2021;8:46–62.
8 Haakenstad A, Harle AC, Tsakalos G, *et al*. Tracking spending on malaria by source in 106 countries, 2000-16: an economic Modelling study. *Lancet Infect Dis* 2019;19:703–16.
9 The United States and malaria: A long history of smart investments that benefit all; 2021. U.S. President's malaria initiative
10 Global technical strategy for malaria 2016-2030. World Health Organization; 2015.
11 Okumu F, Gyapong M, Casamitjana N, *et al*. What Africa can do to accelerate and sustain progress against malaria. *PLOS Glob Public Health* 2022;2:e0000262.
12 Gao L, Shi Q, Liu Z, *et al*. Impact of the COVID-19 pandemic on malaria control in Africa: A preliminary analysis. *Trop Med Infect Dis* 2023;8:67.
13 Aborode AT, David KB, Uwishema O, *et al*. Fighting COVID-19 at the expense of malaria in Africa: the consequences and policy options. *Am J Trop Med Hyg* 2021;1:104:26–9.
14 Formenti B, Gregori N, Crosato V, *et al*. The impact of COVID-19 on communicable and non-communicable diseases in Africa: a narrative review. *Infez Med* 2022;30:30–40.
15 Diptyanusa A, Zablon KN. Addressing budget reduction and reallocation on health-related resources during COVID-19 pandemic in malaria-Endemic countries. *Malar J* 2020;19:411.
16 Rogerson SJ, Beeson JG, Laman M, *et al*. Identifying and combating the impacts of COVID-19 on malaria. *BMC Med* 2020;18:239.
17 The potential impact of health service disruptions on the burden of malaria: a Modelling analysis for countries in sub-Saharan Africa. World Health Organization; 2020.
18 Lal A, Abdalla SM, Chattu VK, *et al*. Pandemic preparedness and response: exploring the role of universal health coverage within the global health security architecture. *Lancet Glob Health* 2022;10:e1675–83.
19 Monroe A, Williams NA, Ogoma S, *et al*. No title, reflections on the 2021 world malaria report and the future of malaria control. *Malar J* 2022;21.
20 Liu W, Liu Y. Youyou tu: significance of winning the 2015 Nobel prize in physiology or medicine. *Cardiovasc Diagn Ther* 2016;6:1–2.
21 Murray CJL, Ortblad KF, Guinovart C, *et al*. Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990–2013: a systematic analysis for the global burden of disease study 2013. *The Lancet* 2014;384:1005–70.
22 Tang K, Li Z, Li W, *et al*. China's silk road and global health. *The Lancet* 2017;390:2595–601.
23 Chen J, Bergquist R, Zhou X-N, *et al*. Combating infectious disease epidemics through China's belt and road initiative. *PLoS Negl Trop Dis* 2019;13:e0007107.
24 Huang Y. China's response to the 2014 Ebola outbreak in West Africa. *Glob Chall* 2017;1:1600001.
25 Alcorn T. New orientation for China's health assistance to Africa. *The Lancet* 2015;386:2379–80.
26 Mlacha YP, Wang D, Chaki PP, *et al*. Effectiveness of the innovative 1,7-malaria reactive community-based testing and response (1, 7-mRCTR) approach on malaria burden reduction in southeastern Tanzania. *Malar J* 2020;19:292.
27 Ma X, Lu S, Wang D, *et al*. China-UK-Tanzania pilot project on malaria control. *China CDC Wkly* 2020;2:820–2.
28 Grépin KA, Fan VY, Shen GC, *et al*. China's role as a global health donor in Africa: what can we learn from studying under reported resource flows? *Global Health* 2014;10:84.
29 Bräutigam D. Aid 'with Chinese characteristics': Chinese foreign aid and development Finance meet the OECD-DAC aid regime. *J Int Dev* 2011;23:752–64.
30 McDade KK, Mao W. Making sense of estimates of health aid from China. *BMJ Glob Health* 2020;5:e002261.
31 Zhang D, Ji H. The new Chinese aid agency after its first two years; 2020.
32 World malaria report 2020: 20 years of global progress and challenges. World Health Organization; 2020.
33 Malik A, Parks B, Russell B, *et al*. *Banking on the Belt and Road: Insights from a new global dataset of 13,427 Chinese development projects*. Williamsburg, VA: AidData at William & Mary, 2021: 23–36.
34 Custer S, Dreher A, Elston T, *et al*. *Tracking Chinese Development Finance: An Application of AidData's TUFF 2.0 Methodology*. Williamsburg, VA: AidData at William mary, 2021.
35 Organisation for economic Co-operation and development DAC working party on development Finance Statistics. In: *Converged Statistical Reporting Directives for the Creditor Reporting System (CRS) and the Annual DAC Questionnaire Annexes–modules A, B, and C*. 2021.
36 Weiss DJ, Lucas TCD, Nguyen M, *et al*. Mapping the global prevalence, incidence, and mortality of Plasmodium Falciparum, 2000–17: a spatial and temporal Modelling study. *The Lancet* 2019;394:322–31.
37 Weiss DJ, Bertozzi-Villa A, Rumisha SF, *et al*. Indirect effects of the COVID-19 pandemic on malaria intervention coverage, morbidity, and mortality in Africa: a Geospatial Modelling analysis. *Lancet Infect Dis* 2021;21:59–69.
38 Chen J-H, Fen J, Zhou X-N. From 30 million to zero malaria cases in China: lessons learned for China-Africa collaboration in malaria elimination. *Infect Dis Poverty* 2021;10:51.
39 Xia Z-G, Wang R-B, Wang D-Q, *et al*. China–Africa cooperation initiatives in malaria control and elimination. *Adv Parasitol* 2014;86:319–37.
40 Nkfusai CN, Ngou O, Subi CE, *et al*. Malaria elimination: what can Africa learn from China. *Int J MCH AIDS* 2022;11:e526.
41 Liu P, Guo Y, Qian X, *et al*. China's distinctive engagement in global health. *The Lancet* 2014;384:793–804.
42 Sohn H. Council on foreign relations. Busan high-level forum: from dead aid to better development; 2011.
43 Dolan CB, Malik AA, Zhang S, *et al*. Chinese health funding in Africa: the untold story. *PLOS Glob Public Health* 2023;3:e0001637.
44 Humphrey C, Michaelowa K. China in Africa: competition for traditional development Finance institutions *World Development* 2019;120:15–28.
45 Lokanathan V. *China's belt and road initiative: implications in Africa*. Observer Research Foundation, 2020.
46 Githaiga NM, Burimaso A, Wang B, *et al*. The belt and road initiative: opportunities and risks for Africa's Connectivity. *China Q of Int' l Strategic Stud* 2019;05:117–41.
47 Zhao Y, Kennedy K, Tang K. Factors influencing the allocation of China's development assistance for health. *J Glob Health* 2018;8:020502.
48 Cervellati M, Esposito E, Sunde U, *et al*. Malaria and Chinese economic activities in Africa. *Journal of Development Economics* 2022;154:102739.
49 Forum on China-Africa Cooperation. Forum on China-Africa cooperation: Beijing action plan 2007–2009; 2006.
50 Roll Back Malaria partnership. The global malaria action plan; 2008.
51 The Abuja declaration: ten years on 2010. World Health Organization;