Malaria in Zanzibar: Raising New Questions About a Public Health Triumph

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1. Introduction

Malaria is spread to humans through mosquito bites, with symptoms ranging from mild (fever, chills and a headache), to more severe (coma, severe anaemia, seizures, and difficulty breathing), and in too many cases death (WHO, 2024a). Infants, children under 5 years, and pregnant women are at higher risk of severe infection. Malaria has long been a scourge of humanity. 40% of the 5,000 year-old Egyptian mummies at the Turin museum in Italy were found to have traces of malaria. It is widely thought that malaria killed both Alexander the Great in India in 326BC and Genghis Khan 1,500 years later (Perry, 2011). The mortality from malaria - which killed 60% of European missionaries to West Africa between 1804 and 1825 – influenced the nature of European colonialism (Acemoglu et al, 2001). The comparative immunity of indigenous inhabitants gave them a decisive advantage in migratory-conquest. Bantu tribes from West Africa spread into East and South Africa, where their descendants– among them the Kikuyu in Kenya, Shona in Zimbabwe, Xhosa and Zulu in South Africa– remain dominant today (Perry, 2011).

In the early 2000s, the World Health Organization (WHO) estimated there were globally between 300 and 500 million cases of malaria a year, resulting in between 700,000 and 2.7 million deaths annually. During that time, 90% of the malaria disease burden was located in Africa (Kumar et al, 2007). The year-round hot temperatures and seasonal rain across most of Africa are ideal for mosquitos, and there is no cold season to kill them off. Unlike other parts of the world, Africa's mosquitos are almost exclusively those that bite humans, including the most malignant species, Plasmodium Falciparum. This boosts the chain, first, of mosquito-to-human and subsequently human-to-human transmission (as mosquitos bite a person with malaria then transfers it to someone else) (Sachs et al, 2004).

In 2000, more than 80 million cases of malaria occurred among African children younger than five years. Approximately 500,000 million of these episodes were severe enough to require hospital admission. At least 20,000 children suffered permanent neurological damage annually as a result of malaria infection (Roll Bank Malaria Partnership, 2011:18). In 2009, the average person in Uganda was bitten by mosquitoes thousands of times a year. Of the 500,000 residents in the Ugandan district of Apac, approximately 124,000 sought treatment for malaria in the year after July 2008, including nearly 60,000 children below the age of five (Perry, 2011). Malaria was both ancient in its malice and contemporary in its virulence.

Malaria can be prevented by avoiding mosquito bites (many would argue through the use of mosquito nets and mosquito repellent applied to skin, coils, protective clothing, and window screens, though evidence is mixed). In recent years, a vaccine has been developed that stimulates the immune system to produce antibodies that block the malaria parasite from infecting liver cells and leading to blood-stage disease. After 2000, these means of malaria prevention were scaled up[2] and improved in such a manner that they helped cause a dramatic global decline in the incidence of and mortality from malaria. Since 2015, 14 countries have been certified by the WHO Director-General as malaria-free, including Maldives (2015), Sri Lanka (2016), Kyrgyzstan (2016), Paraguay (2018), Uzbekistan (2018), Argentina (2019), Algeria (2019), China (2021), El Salvador (2021), Azerbaijan (2023), Tajikistan (2023), Belize (2023), Cape Verde (2024) and Egypt (2024) (WHO, 2024a). In 2021, the WHO set new global targets to reduce malaria cases and mortality by at least 90% and to eliminate malaria in at least 25 countries by 2030 (WHO, 2024a).

[2] Insecticide treated bed-nets after 2006 and a malaria vaccine after 2022.

This paper focuses on the case study of Zanzibar where efforts to eliminate malaria were a globally important success. The incidence of malaria fell faster than elsewhere, despite the island being vulnerable because of the mobility associated with being a tourist destination and having exposure to endemic malaria in mainland Tanzania. The decline was primarily due to sustained and successful efforts led by the government of Zanzibar in partnership with the global malaria community. This paper asks six big questions for Zanzibar. Looking back, why did malaria decline? Looking forward what will the economic benefits be to Zanzibar of this public health success story? This paper asks what are the lessons for Zanzibar and elsewhere regarding this public health success story? Here the paper touches on a puzzle, both the government of Zanzibar and the global public health community are surprisingly quiet about this public health triumph. Thinking about public health policy today the paper asks what are the risks of a resurgence of malaria in Zanzibar, whether malaria will become an urban phenomenon in the near future, and what are the policy implications of moving towards malaria elimination in Zanzibar? The paper concludes with a big picture idea, that thinking about malaria in Zanzibar requires moving away from a dominant paradigm in global and Zanzibar thinking, the centrality of institutions, towards a focus on health as both an input into and a crucial outcome of the process of economic development.

This paper is organized as follows, section two reviews the recent global efforts to eliminate malaria, section 3 focuses on the specific context of Zanzibar, section 4 asks six questions about malaria in Zanzibar, and section 5 concludes.

2. Global Efforts to Eliminate Malaria

Successful efforts to eliminate malaria in the 1950s were widely abandoned in the 1960s leading to a resurgence of malaria in many countries. New evidence on the economic and human cost of malaria in the 1990s helped inspire a new global elimination effort. A big push backed by global leaders, funding, and research was launched in the early 2000s, leading to a dramatic global reduction in the incidence of malaria, and after 2012, the successful trial and later in 2022 the scaling up of a malaria vaccine. After 2015 the WHO verified the complete elimination of malaria in a succession of countries.

2.1. From Near Elimination to Inertia

Global malaria was nearly eliminate d in the 1950s. In 1874 carbon, hydrogen, and chlorine were first synthesized into dichloro-diphenyl-trichloroethane (DDT). In 1939, Swiss chemist Paul Hermann Muller discovered the properties of DDT as an insecticide, for which he won the Nobel Prize for medicine in 1948. DDT was cheap to produce and seemingly harmless to people. Led by the nascent post-war global public health community, DDT was sprayed on walls, fields, and swamps and dropped from the air. In the US, malaria was eliminate d by 1952. In Sri Lanka the number of malaria cases declined from 3 million in 1946 to 18 in 1963 (Perry, 2011). In India, the number of malaria cases declined from 75 million in 1947 to 100,000 by 1964 (Kumar et al, 2007).

In 1962, Rachel Carson published her book *Silent Spring* which made a case that by entering the food chain DDT was threatening entire eco-systems and pushing species like the Bald Eagle towards extinction. The WHO stopped funding the DDT campaign in 1963 and banned DDT in 1972. While large parts of the world– including Europe, the US, Russia and parts of Asia– subsequently remained malaria free, infections in other regions skyrocketed. For example, in Sri Lanka, the number of cases jumped from 18 in 1963 to one million cases per year by 1969

(Perry, 2011). By the 1990s, malaria remained low on the global public health agenda; in 1996, the WHO spent only $9 million on malaria control in Africa.

Research including the 1993 *World Development Report* by the World Bank and economic studies by academics such as Jeffrey Sachs (see Section 4.2) quantified the link between malaria and development by revealing the scale of the economic burden of malaria. Business, development organisations, and national governments began to see more value in fighting malaria (Perry, 2011).

2.2. A New Big Push

Jeffrey Sachs framed the anti-malaria intervention needed in terms of a 'big push' arguing that "targeted investments backed by donor aid lie at the heart of breaking the poverty trap" (Sachs, 2005:250). By the 1990s, evidence of the successful scaling up of public health programs had accumulated, such as the high-yield variety (HYV) wheat seeds first used in Mexico that went on to prompt a global green revolution in agriculture, and the global (near elimination) of smallpox and polio between the 1960s and 1980s. The key lessons revolved around the importance of leadership, financing, and the provision of technology appropriate to local conditions that allowed for a rapid and sustained scaling up (Sachs, 2005). In relation to malaria, the required big push constituted simultaneous efforts to address research into malaria prevention, development of a vaccine, provision of treatments, and data collection on malaria prevalence to monitor the success of these efforts. Much of this discussion was framed around the need for developed countries to commit themselves to providing 0.7% of GDP in aid every year (Sachs, 2003).

2.2.1. Leadership

The late 1990s and early 2000s saw a complete transformation of the global politics of malaria. The Roll Back Malaria (RBM) Partnership was launched in December 1998 with pro-active cooperation from the WHO, UN Children's Fund, World Bank (WB), and United Nations Development Programme (UNDP). The UN Millennium Development Goals (MDGs) in 1999 identified malaria as a key priority. In 2000, 44 African countries formally committed themselves to halving malaria by 2010 (Perry, 2011).

Case studies of successful intervention efforts across Vietnam, Eritrea, Brazil, and India show that a unique feature of these four country programs was the presence of a lead partner agency that provided technical and programmatic support. In Eritrea, the US Agency for International Development (USAID) played a major role, in Vietnam and Brazil the Western Regional Pacific Office of WHO (WRPO) and the Pan-American Health Organization (PAHO), respectively, and in India, local health departments (Barat, 2006). The global malaria community was led by the RBM Partnership, which coordinated a global response to control, eliminate and eventually eliminate malaria through the Global Malaria Action Plan (Gates Foundation, 2011).

2.2.2. Financing

Funding was ramped up in response to these political commitments to fighting malaria. The Bill and Melinda Gates Foundation, formed in 1999, made funding malaria research and treatment an early priority. In April 2005, the World Bank launched a three-year malaria campaign, setting aside $500 million to fund it. In 2005, President Bush announced the formation of the President's Malaria Initiative, with a five-year $1.2 billion budget to provide Tanzania, Uganda and Angola with insecticide-treated bed-nets, treatment drugs and

insecticide spraying (Perry, 2011). By 2023, global funding for malaria control and elimination totalled $4 billion across 90 countries with the WHO African Region receiving 75% of this funding (WHO, 2024b:xx). In 2023, malaria research and development (R&D) funding reached $690 million. Of this total $201 million was donated by the United States National Institute of Health and $181 million by the Bill & Melinda Gates Foundation, the largest funders of R&D (WHO, 2024b:xx). The Gates Foundation provided grants to develop and disseminate a malaria vaccine, ensure access to affordable treatments, and collect evidence about which set of interventions would have the most impact on interrupting malaria transmission (Gates Foundation, 2011).

2.2.3. Expansion of Preventative Measures

In 2010, the WHO recommended that universal diagnostic testing was necessary to confirm malaria infections and treat them accordingly. Prompt diagnostic testing reduces the over-use of expensive malaria treatments such as Artemisinin-based combination therapies (ACTs) and prevents other causes of fever from being inappropriately treated (Roll Bank Malaria Partnership, 2011). Spending on diagnostic tests increased rapidly after 2010 (Roll Bank Malaria Partnership, 2011). Between 2010 and 2023, manufacturers reported 4.4 billion sales of rapid diagnostic tests (RDTs) for malaria and 4.5 billion ACT treatment courses (WHO, 2024b:xix). Analysis of household surveys conducted in SSA between 2005 and 2023 found that ACT use among children who sought care and who were treated with an antimalarial drug increased from 38% (2005–2011) to 71% (2017–2023) (WHO, 2024b:xix). In the early 2000s, anti-malarial bed-nets were used by less than 1% of rural Africans living in endemic malarial regions (Sachs, 2005). In response, insecticide-treated nets (ITNs)–nets that needed an annual treatment to remain fully effective–were marketed to at-risk populations, mainly young children and pregnant women. In Tanzania, ITNs were found to be linked to 55-75% reductions in malarial morbidity for children aged six months to two years (Sachs et al, 2004:157). Within a few years, long-lasting insecticidal nets (LLINs) were developed which no longer required regular chemical treatments to be made effective. More than 400 million LLINs had been delivered to African countries by the end of 2010. Increase in coverage was done equitably, with UNICEF buying and disseminating 164 million nets between 2000 and 2010. That was enough to provide LLINs to 80% of the people at risk of malaria across Africa (Roll Back Malaria Partnership, 2011). By 2023 an estimated 73% of households in sub-Saharan Africa (SSA) owned at least one ITN, compared with 68% in 2015, and 52% of the population were sleeping under an ITN, compared with 46% in 2015 (WHO, 2024b:xviii).

2.2.4. And Finally, the Vaccine

In 2005, the malaria community adopted a Malaria Vaccine Technology Roadmap that called for the development of a first-generation malaria vaccine by 2015, and a second generation malaria vaccine by 2025 (MVI, 2012c). The vaccine aimed to have at least an 80% efficacy against clinical malaria, most importantly in children under the age of five and in pregnant women (MVI, 2012b). This effort was led by the PATH Malaria Vaccine Initiative (MVI), an international non-profit organization with long experience in forging multi-sector partnerships, and expertise in science, economics, technology, and advocacy (Path, 2025).

PATH's work encompassed early-stage identification of targets for malaria vaccines, preclinical, clinical, and advanced clinical trials (MVI, 2012c). PATH also worked to help ensure that malaria vaccines would be affordable and available where needed on a scale equivalent to other standard childhood vaccines (MVI, 2012a). PATH focused on establishing partnerships to manufacture and disseminate malaria vaccines that would not be hindered by

intellectual property issues creating commercial barriers to vaccine development (MVI, 2012b). Many large private sector pharmaceutical companies joined the effort. In 2012, GSK noted that they were "determined to help stop malaria" (GSK, 2012). GSK recorded their malaria strategy as focused on three areas: (1) R+D for new malaria treatments and vaccines; (2) community investment activities through African Malaria Partnerships; and (3) preferential pricing for anti-malaria drugs in Africa and other least developed countries. In 2012, the leading vaccine candidate was RTS, developed in partnership with PATH MVI and supported by grants from the Bill and Melinda Gates Foundation (GSK, 2012).

By 2023, two malaria vaccines (RTS,S and R21) were recommended for use in malaria endemic areas. The RTS,S malaria vaccine was initially piloted in Ghana, Kenya and Malawi, where more than 6 million doses were delivered to 2 million children between 2019 and 2023. An impact evaluation demonstrated a 13% reduction in all-cause mortality (excluding injury) and a 22% reduction in hospitalizations for severe malaria among children. By December 2024, 17 countries had introduced malaria vaccines through routine childhood immunization, and additional countries had expressed plans to introduce the malaria vaccine in 2025 (WHO, 2024b:xviii).

2.2.5. The Results

Modelling shows that the number of malaria cases in Africa in 2009 (176,000), was 21% lower than would have been expected due to population growth in a world without global interventions (Roll Back Malaria Partnership, 2011:54-5). Between 2000 and 2010, an estimated 1.1 million child malaria deaths were averted in SSA (Roll Back Malaria Partnership, 2011). Between 2000 and 2023, an estimated 2.2 billion malaria cases and 12.7 million malaria deaths were averted worldwide, with 1.7 billion cases and 12 million deaths prevented in Africa alone. In 2023 alone, more than 177 million cases and more than 1 million deaths were averted globally (WHO, 2024b:xvi). It was widely acknowledged that "global funding of malaria control in the past decade clearly has been one of the most productive health investments ever" (Roll Back Malaria Partnership, 2011:18).

3. Zanzibar: A Public Health Success

Efforts to eliminate malaria in Zanzibar were a globally important success. The incidence of malaria on the island fell faster than elsewhere, despite the island being vulnerable to the mobility associated with tourism and other factors combined the resurgence of malaria in mainland Tanzania. This was linked to sustained and successful efforts led by the government of Zanzibar in partnership with the global malaria community.

3.1. Declining Malaria in Zanzibar

Across Africa after 2000, the most successful countries were those that reduced the incidence of and mortality from malaria by 50%. Zanzibar went much further, to near elimination. One study using data collected from 129 public outpatient facilities in Zanzibar found a 90% reduction in the mean incidence of malaria between 2000 and 2015 (Ashton et al, 2019). Using a combination of outpatient and inpatient cases and mortality, another study found that between 1999 and 2008, malaria deaths had fallen by 90%, malaria in-patient cases by 78%, and confirmed malaria outpatient cases by 99.5%. Among under-fives, the proportion of all-cause deaths due to malaria fell from 46% in 1999-2003 to 12% in 2008 (Aregawi et al, 2011). An in-depth study of two districts, both with a 100,000 plus population, using a variety of hospital

and community surveys, found that the incidence of malaria declined by 94% between 2003 and 2015, with most of that concentrated in the years 2004 to 2007. The all-cause mortality of children under the age of five years dropped by 72% between 2002 and 2007 (Bjorkman et al, 2019). By 2010, it was estimated that Zanzibar was averting 660,000 malaria cases and 3300 malaria attributable deaths per year. Based on data for spending on intervention measures, this translated into $1,183 per death averted, in line with the world's most cost-effective public health interventions (Smith, 2010).

3.2. Not a Favourable Starting Point

Zanzibar did not have a favourable starting point. In 2002, malaria transmission in Zanzibar was as intense as anywhere else in Africa (Smith, 2010). The rapid decline in the incidence of malaria in Zanzibar did not simply reflect a regional trend that Zanzibar was a lucky participant in. by 2023 malaria in Zanzibar was lower than all the neighbouring areas, including Kenya and mainland Tanzania (Ali et al, 2023). The East African region showed a very varied pattern in most cases falling more slowly than in Zanzibar. In coastal Kenya, malaria admissions into hospitals declined by 75% between 2003 and 2007. In lowland Kenya around Lake Victoria, there was a 42% reduction in all-cause child mortality between 2003 and 2007. In some regional examples malaria was more stubborn. Data compiled from inpatient record across 17 hospitals in western Kenya, showed substantial decline in malaria admissions in only four of them (O'Meara et al, 2010). In the Muheza district of Tanzania, the number of malaria cases increased between 1994 and 2006, with prevalence among children remaining consistently above 80% (O'Meara et al, 2010). By 2022 the prevalence rate of malaria in Zanzibar was below one percent, lower than anywhere else in Tanzania, or Eastern and Central Africa (WHO, 2022).

3.3. Tanzania: An Enduring Malaria Problem

Even by 2023, there were still an estimated 263 million malaria cases that resulted in almost 600,000 deaths across 83 countries (WHO, 2024a). Between 2019 and 2023, there were substantial increases in estimated case numbers in Nigeria (reaching 6.8 million), Ethiopia (6.9 million), Madagascar (4.2 million), the Democratic Republic of the Congo (1.8 million), Uganda (1.3 million), Mali (1.4 million), Cameroon (1.2 million), and importantly for this paper, Tanzania (1.9 million) (WHO, 2024b:12). Africa suffered 94% of those malaria cases and 95% of deaths, with 76% of deaths occurring in children under five (WHO, 2024b). Over half of these deaths occurred in four countries: Nigeria (30.9%), the Democratic Republic of the Congo (11.3%), Niger (5.9%) and important for this paper, Tanzania (4.3%).

Striving for elimination in an environment where the prevalence of malaria in rest of Tanzania was more stubborn or even seeing resurgence was even more impressive given the status of Zanzibar as both a tourist destination and being economically dependent on the mainland. Between 2015 and 2020, data collected by Zanzibar's Malaria Case Notification (MCN) system showed that 40% of malaria cases had a travel history outside Zanzibar in the month prior to testing positive for malaria (Bisanzio et al, 2022). One study used mobile phone usage data and ferry traffic between Zanzibar and the Tanzania mainland to model malaria and found that malaria infections in Zanzibar were largely imported (Le Menach et al, 2011; Bjorkman et al, 2019). As a tourist hub, Zanzibar was importing the consequences of weaker efforts to control malaria elsewhere in the East African region (Bisanzio et al, 2022).

4. Six Big Questions About Malaria for Zanzibar

This section looks backwards and forwards from 2025 to ask six big questions for Zanzibar. Why did malaria decline? Where are the Lessons for Zanzibar and Elsewhere about this Public Health Success Story? What are the Economic Benefits of Malaria Reduction? What are the Risks of a revival in Malaria in Zanzibar? What are the Policy Implications of Moving Towards Malaria Elimination in Zanzibar? Will Malaria become an Urban Phenomenon in Zanzibar?

4.1. Why Did Malaria Decline?

The answer to the first question is clear. The anti-malaria campaign in Zanzibar was launched in September 2003, led by the Ministry of Health and supported by various local and international partners. The campaign consisted of ensuring the widespread availability of ACTs in all public health facilities, vector control measures including free LLIN distribution to all children and pregnant women, and efforts to spray buildings and water-rich areas (Roll Back Malaria Partnership, 2011:71). These interventions were large in scale. A targeted mass distribution of free LLINs to children under five and pregnant women was launched in August 2005 (Beer et al, 2010). The 712,782 ITNs distributed in 2021 (including carry-over from 2020) in Zanzibar, were more than the whole of mainland Tanzania, 611,717 (WHO, 2024b:156). The respective populations of Zanzibar (1.9 million) and Tanzania (64.7 million) make the comparison even more stark (Worldometer, 2025). Two cross-sectional surveys across 509 respondents were conducted in May 2006 in two districts, in Pemba Island and Unguja Island to evaluate the impact of LLIN distribution. The overall proportion of children under five sleeping under any type of treated net was 83.7% in Pemba and 91.8% in Unguja and the usage of modern LLINs reached 56.8% and 86.9% in the two islands respectively (Beer et al, 2010).

There is clear evidence that these efforts had a direct impact on the incidence of malaria. Using data on the time-trend of malaria incidence across 129 public outpatient facilities between 2000 and 2015 (accounting for climate, seasonality, diagnostic testing rates, and outpatient attendance) average monthly incidence of confirmed malaria showed no trend between 2000 and 2003. Malaria only started declining once the government introduced ACT treatments on a large scale (2003-2005), and continued declining when the government introduced free LLIN in 2005 (Ashton et al, 2019). Another study found that the combination of LLINs, indoor spraying, and ACT together reduced the burden of malaria registered in health facilities by 75% in the five years after 2003 (Aregawi et al, 2011).

Government intervention efforts improved over time. As per the recommended best practice, since 2012, Zanzibar has implemented reactive case detection and treatment (RACDT) methods. This involved health staff notifying individuals by phone about malaria status, which in turn triggered a review of health records and malaria testing and treatment at the household level by a district malaria surveillance officer (van der Hosrt et al, 2020). Related to this is the malaria case notification (MCN) procedure deployed in Zanzibar to positive effect. Starting in 2012 the MCN in Zanzibar collects detailed sociodemographic and epidemiological data from all confirmed malaria cases. Between 2012 and 2021, among almost 50,000 malaria cases that were confirmed at health facilities, 85.7% were then fully followed up and investigated at household level, where more than 110,000 household members were then tested with RDTs (Mkali et al, 2023). Another study reviewed two years (2015–2016) of related data across 40 randomly selected health facilities. The operational coverage of the system was calculated as the proportion of registered cases that were successfully reviewed and followed up at the household level. The survey found that public health facilities notified (within one day) almost

all registered cases (91% in Unguja and 87% in Pemba). This was entirely a public-sector success; records and data from private health facilities on Unguja indicated poor notification performance in the private sector (van der Hosrt et al, 2020).

In 2017, the government announced new targets for 2022. These included rapid diagnosis available in 100% of health facilities, vector control measures (spraying and LLINs) expanded to 100% of households at risk, and reinforced surveillance of malaria to ensure 100% of cases were classified and confirmed (WHO, 2022). A review conducted in September 2022 by the government and development partners, confirmed that all these objectives were almost reached, taking Zanzibar very close to the elimination of malaria. 95% of targeted structures had been sprayed with insecticides. LLIN distribution reached the rate of one net for every 1.8 people, even better than the ideal of one net per every two people (WHO, 2022). The review also found a strong system for malaria reporting through national health information, with case investigation improving from 73% in (2017/18) to 92% (2020/21) (WHO, 2022; Ali et al, 2023).

4.2. What are the Economic Benefits of Malaria Reduction?

There is widespread evidence to show that health improves as a consequence of economic growth. In regard to malaria more household income will allow households to seek and (via taxation) governments to provide public health services. This section focuses on the economic benefits of improvements in public health in general and malaria in particular. The Zanzibar context (tourism and foreign investment for example) mean that these benefits are likely to be highly relevant. There is no indication in government planning documents that this question has been answered and factored in to economic thinking in Zanzibar.

There is global evidence that shows several economic take-offs, such as rapid growth of Britain during the Industrial Revolution, the US south and Japan in the early 20th century, and southern Europe and East Asia beginning in the 1950s and 1960s. Each were supported by important breakthroughs in public health, disease control and improved nutritional intake (CMH, 2001). Data shows that between the 1960s and 1990s, for any given initial income level, countries with lower infant mortality rates experienced higher economic growth during the period (CMH, 2001:23). Another study found that more than half of Africa's growth shortfall relative to East Asia could be explained by the greater disease burden in Africa (Bloom et al, 1998). In 1995, the average income (GDP per capita) of 54 countries that faced intensive malaria was $1,526 compared to $8,268 in 96 countries without (Gallup and Sachs, 2000). Between 1965 and 1990, countries with intensive malaria grew by 0.4% p.a., compared to 2.3% in countries without (Gallup and Sachs, 2000). Those countries who were able to eliminate malaria typically experienced a subsequent acceleration in economic growth. Such examples include Greece, Italy, and Spain in the 1930s and 1940s, Portugal after 1958, Taiwan in 1961, Jamaica in 1958, and the Southern states of the US in the 1960s (Gallup and Sachs, 2000).

Research has also focused on the household or microeconomic impact of malaria that can help explain these macroeconomic outcomes. Evidence from Malawi in the 1990s showed that the direct costs of malaria treatment were equivalent to 28% of household income among very low income households, and 2% among the rest (Sachs, 2005). Malaria also generates a significant material demand on the limited governmental resources in Africa. One study of Rwanda estimated that almost 20% of the Ministry of Health budget was spent on malaria treatment (Chima et al, 2003). The average time lost per episode for both sick children and adults ranges from one to five days. In Kenya, primary school students were estimated to have, on average,

four episodes of malaria per year and to miss on average five days of school per episode, equalling more than 10% of Kenya's school year (Chima et al, 2003). The national malaria elimination program in India in the 1950s led to higher per capita household expenditures in the subsequent decades through boosting labour productivity among males (Culter et al, 2010). Malaria can have more invidious impacts on schooling and workplace productivity than a mechanical accumulation of time lost in school and employment. Malaria can cause anaemia in pregnant women, which leads to a greater risk of intra-uterine growth retardation and low birth-weight, increasing the likelihood of poor health outcomes and lost schooling later in life (Chima et al, 2003). The WHO estimates the scale of this benefit. In 2023 pregnancy-specific malaria treatment averted an estimated 551,000 low-weight births, about half of these occurring in West Africa (WHO, 2024:27). A child that catches malaria in the first few months of life is at increased risk of permanent cognitive damage (known as 'scarring'), leading to less accumulation of learning, lower labour force productivity, and decreased wages in later life (Chima et al, 2003). One review of 44 studies found a consistent relationship between malaria and reduced cognitive abilities and school performance of children even after recovery (Fernando et al, 2010).

Various studies (some noted above) have demonstrated a clear link between improved public health and economic outcomes. Others studies have found a positive link harder to identify. One study uses global health improvements in the 1940s to estimate the impact of increased life expectancy on economic outcomes. The study finds that reduced mortality increased life expectancy but had little impact on total GDP (Acemoglu and Johnson, 2007). Another study found that the elimination of malaria could even reduce average incomes through reducing the mortality of children and diverting resources from investment to consumption and schooling (Ashraf and Lester, 2009:159). Any effort to look forward in Zanzibar must take into account the fact that the near elimination of malaria it is about more than just the link between reduced mortality and economic growth. The reduction of malaria is likely to impact fertility as well as mortality and both children's attendance in school and their ability to learn in the classroom (Kim, 2004).

One study combines household microdata from the Demographic and Health Surveys (DHS) across 27 countries in Sub-Saharan Africa with detailed maps of malaria risk generated by the Malaria Atlas Project (MAP) and country-year financial disbursements from RBM campaigns (Kuecken and Thuilliez, 2017:4). The results confirm earlier studies, health aid from the RBM reduced infant mortality (by 5.2 percentage points), but also reduced fertility (by 0.4 births), increased adult labour supply (up by 5.3 percentage points) and increased educational attainment (by 0.5 years) (Kuecken and Thuilliez, 2017:5). A similar study modeled the interaction of mortality, illness, and parental decisions related to education and fertility. The study again uses regional variation in the intensity of the RBM campaign as a measure of anti-malarial interventions. The study finds that the reduced prevalence of malaria reduced fertility (by 5.9%) and led to increased school attendance (0.63 more years for the children benefiting from the intervention). The model predicts that per capita income would rise by 34% within 60 years. The boost comes through reduced fertility and households investing more in the education of a reduced number of children (Kim, 2024).

The economic growth implication of the near elimination of malaria in Zanzibar is of first-order relevance for the government. Zanzibar Vision 2050 targets the island achieving upper middle income status by 2050 (RGZ, 2020:1). The Vision roots this target in a backward glance at the interplay between economic growth (6.1% on average between 2009 and 2019) and population growth (2.8% annual average) (RGZ, 2020:6). As noted above economic growth

and fertility decisions are both influenced in other contexts by declining malaria. Looking forward Vision 2050 targets economic growth across the 2020s (9-10%), 2030s (7-8%), and 2040s (5.5-6.5%) (RGZ, 2020:9). Elsewhere the Vision targets an increase in tourists, from 540,000 in 2019 to 1.4 million in 2050 (RGZ, 2020:18); making Zanzibar an attractive destination for foreign investment (RGZ, 2020:25); and that "Zanzibar needs a healthy workforce with relevant skills and talents to serve the local labour market as well as to contribute and compete as global citizens" (RGZ, 2020:27) – variables also closely influenced by malaria.

Vision 2050 does briefly acknowledge the multi-faceted benefits from having a healthy workforce, including the direct welfare benefits for people as well as the more indirect economic benefits:

*"*Zanzibar needs a healthy workforce with relevant skills and talents to serve the local labour market as well as to contribute and compete as global citizens. The stock of human capital has to be served by adequate social services, with education and health in particular as important flows needed to mould the capable and competitive Zanzibaris of tomorrow" (RGZ, 2020:27).

The economic benefits of health are noted only in passing and the implications are not discussed in any detail in Vision 2050. Health is headlined as a social goal for individuals, households, governments, firms, donors, and international organizations to pursue.

"A modern healthcare delivery system supported through effective investment plans and related interventions with a focus on human capital development, research, health infrastructure, medical technology, digital health systems, quality control as well as specialized medical and health practitioners and services" (RGZ, 2020:35).

The implication is that a combination of general economic growth and policy-targeted health outcomes will boost health outcomes in Zanzibar. There is good reason to suppose this, as increased incomes provide households with the resources to pay for health care, better nutrition, education, and housing and the government with tax revenues to invest in the health care system. As one study found, the "wealthier is healthier" (Pritchett and Summers, 1996). Aside from the brief reference noted above, Vision 2050 makes no general references to health (or specific references to reduced malaria) as an input into development, that a healthier nation will become a wealthier nation.

4.3. Where are the Lessons for Zanzibar and Elsewhere about this Public Health Success Story?

The near-elimination of malaria in Zanzibar represents a striking success in public policy, not just reflecting global donor commitment, but also the sustained, targeted, scientifically-empirically-politically driven domestic commitment by the government of Zanzibar. The success was achieved despite the stubborn presence of malaria in mainland Tanzania and the importation of this through Zanzibar's status as a tourist destination and wider economic dependence on the mainland. Reflecting on this achievement despite difficult conditions, in 2022 the WHO Country Representative in Tanzania said "The evidence of an ever-decreasing rate of malaria in Zanzibar proves that with collaboration and efforts at community, facility and policy level, we can achieve goals that may seem elusive" (WHO, 2022a). Closely involved in the anti-malaria effort in Zanzibar are RBM who declare that one of their main functions is to, "facilitate peer learning on delivering or implementing new tools or approaches through

sharing of experiences, lessons learned and best practices" and to "facilitate South-South learning, and to generate lessons from operational and implementation research" (RBM, 2020:24). They declare that the "RBM Partnership will be a "bridge" for feeding the evidence and experience of endemic countries and affected communities back into global forums on policy, guidance and financing" (RBM, 2020:24).

The stated importance of learning lessons from malaria organisations can be contrasted with their near complete failure to do so in practice. This surprising lack of reflection on the success of efforts to (nearly) eliminate malaria in Zanzibar can be seen in reports from multi-lateral organisations. In a 2023 report examining public service provision the World Bank mentions health care in Zanzibar twenty times but fails to mention malaria once (World Bank, 2023). Another example is the 2023 WHO Joint Evaluation Exercise (JEE) to evaluate the implementation of the 2005 international health regulations (WHO, 2023). The mission examined Zanzibar's capacities in 19 technical areas through a consultative process between international and national experts. The JEE praises Zanzibar's effort in relation to non-malaria disease (ignoring malaria), "Case management guidelines/SOPs are available for some highly infectious diseases (COVID-19, Ebola virus disease, cholera) which were disseminated and oriented/trained from national to health facility levels" (WHO, 2023:49-51). The JEE rates Zanzibar as having "developed capacity" in relation to vaccine coverage and sustainable capacity in relation to "national vaccine access and delivery" (WHO, 2023:3). The JEE derives this favourable assessment from an understanding of immunisations where they note that, "Zanzibar has a robust Expanded Programme on Immunization (EPI) which was established with the primary aim of protecting children from VPDs, and an overall goal of contributing to the reduction of infant and childhood morbidity and mortality rates. The programme has a monitoring and evaluation unit whereby all indicators are reviewed and evaluated monthly.

The coverage is closely monitored so that timely action can be taken through a well-structured system at national, zonal, district and health-facility levels." (WHO, 2023:28-30). According to the JEE, in Zanzibar there is "a strong health system with wide and adequate distribution of the health facilities that have a good coverage. Access to the health services is free and there is strong commitment from the government and partners to support health service delivery. Zanzibar has available expertise for health[3] case management and has policy documents, guidelines, and SOPS to facilitate health service provision. There is a strong health management information system (HMIS) in place and an essential package of health services for health emergencies." (WHO, 2023:49-51). There are no discussions of how this capacity was built up in the context of the anti-malaria campaign. The JEE is less flattering about testing, rating laboratory testing and quality capacity as "no capacity" (WHO, 2023:3). Only a year before, the WHO had declared that Zanzibar offered "brilliant rate of testing before treatment using rapid tests" and lacked "microscopes or limited skills to undertake microscopic services" (WHO, 2022a). The JEE rates the capacity of Zanzibar to increase its health workforce "during a public health event" as "no capacity" and the "human resources for implementation of international health regulations" as of "limited capacity", though concedes "workforce training" shows "demonstrated capacity" (WHO, 2023:4). The WHO recommends urgent attention to mapping existing human resource skills and to develop human resources to cope with public health emergencies. There is no mention of the malaria campaign in any of this assessment (WHO, 2023:4).

[3] Expertise for essential health case management while being dependent on the mainland for more complex health interventions.

We would expect to see Zanzibar, particularly the government, publicly celebrating this success and integrating the implications for near-elimination into their medium term economic planning. Tourism for example has a significant presence in government planning documents, but there is no discussion of how the near elimination of malaria can boost tourist arrival numbers. Recall Section 2 in this paper, which showed that malaria has negative impacts on tourism. In Greece and Spain (1930s and 1940s) and Jamaica (1958) the elimination of malaria was a pre-condition for the development of large-scale tourism (Gallup and Sachs, 2000).

Vision 2050 is all but completely silent about malaria. Malaria gets two mentions in Vision 2050. One mention dismisses the success with faint praise: "Though efforts to control HIV/AIDS, malaria and gastro-intestinal diseases have been relatively successful, there is an increasing concern of emerging non-communicable diseases (NCDs) as well as perinatal, neonatal and infant mortality" (GRZ, 2020:35). The second references malaria in terms of a climate change induced threat: "Ecological stability is further threatened by climate change, which could potentially affect future livelihoods, with children in particular at greater risk of food and water scarcity; vector and water-borne diseases, such as malaria, dengue and cholera as well as air pollution" (GRZ, 2020:62). By comparison the health plan in Kenya for 2023 to 2027 includes detailed discussion and analysis of malaria. Malaria is mentioned in the report 41 times. There are detailed presentations of data showing how the prevalence of and mortality from malaria declined in different geographic regions as well as the roll out of vaccines (Government of Kenya, nd:32). The prevention, diagnosis, and treatment of malaria is ascribed the status of 'strategic goal' (Government of Kenya, nd:43). There are clear annual targets to reduce the incidence of malaria for every year between 2023/24 and 2027/28 (p45) and targets for the number of ITNs distributed, coverage of IRS in target areas, vector surveillance reports completed, procurement of anti-malarial medicines and malaria diagnostic kits (p66) and the project is fully costed (p122).

4.4. What are the Risks of a revival in Malaria in Zanzibar?

The next two questions are more forward looking, Zanzibar needs to think carefully about the risks of malaria resurgence and make decisions about the volume and nature of resources to invest in making a final push to eliminate malaria. Zanzibar reduced malaria to very low levels by 1969, but these gains were not sustained and the island experienced a resurgence in the 1980s and 1990s (Smith et al, 2010:1384). History could repeat itself. The risks of malaria resurgence are real which may occur through migration of infected people or insecticide or artemisinin resistance among others.

Since 2020, the number of estimated malaria cases has steadily increased, and most of this increase occurred in countries in the WHO African Region (89.7%) and the WHO Eastern Mediterranean Region (15.5%). Twenty-four countries (26%) experienced an increase in case incidence, with 15 countries (16%) experiencing an increase of 63% or more in 2023 compared with 2015 (WHO, 2024:30). The main countries contributing to the increase in cases between 2022 and 2023 were Ethiopia (+4.5 million), Madagascar (+2.7 million), Pakistan (+1.6 million), Nigeria (+1.4 million) and the Democratic Republic of the Congo (+600,000) (WHO, 2024:8). In 14 countries malaria case incidence in 2023 was similar to that of 2015 meaning almost a decade of progress had been lost (WHO, 2024:30). One study found a "steady increase in the annual parasite incidence (API) was observed in Zanzibar, from 2.7 (2017) to 3.6 (2021) cases per 1,000 population with marked heterogeneity between areas" (Ali et al, 2023:10).

An older example which provides a dramatic warning is that of Sri Lanka. Sri Lanka launched a malaria elimination programme in 1958 mainly structured around DDT spraying and the incidence of malaria declined rapidly in the early 1960s. After spraying was abandoned, the number of malaria cases increased from 18 in 1963 (Perry, 2011) to over half a million cases in 1969, and continued to rise into the 1980s (Karunaweera et al, 2014). Since being declared malaria free (no indigenous cases) in 2012 the sustainability of that elimination have been questioned, no doubt with the lesson of the 1960s in mind. In Sri Lanka a booming tourist industry and the influx of labour (partly due to foreign investment in manufacturing and tourism) and refugees from neighbouring malarious countries renders Sri Lanka vulnerable to a resurgence. There is also a concern that malaria-awareness is declining among medical professionals who are delaying diagnoses and diverting resources to other medical priorities (Premaratne et al, 2014). Sri Lanka has very good diagnostic coverage (microscopes and rapid diagnostic tests) but they are being used less frequently, even for individuals with fever and a recent history of travel to a malaria endemic country (Dharmawardena et al, 2015). The lack of backward reflection and forward thinking about malaria (as noted in Section 4.3) will make similar concerns valid for Zanzibar.

Another risk factor is the arrival of a new mosquito species. The human biting *Anopheles* mosquito, of which there are around 130 species in Africa are predominantly found in water-rich rural areas (Takken and Lindsay, 2019). By contrast, the larvae of the *Anopheles stephensi* thrive in habitats like abandoned tires or cisterns that are commonly found in urban areas (Lehmann et al, 2023). An. stephensi is native to Asia and the Middle East and has been spreading slowly across Asia for the last three decades reaching Goa in the 1970s, southern India in the 1980s, and Sri Lanka in 2017, it was also detected in Djibouti (2012) and in Ethiopia (2016) (Takken and Lindsay, 2019; Lehmann et al, 2023). By 2023 An. stephensi had crossed into Ghana and Nigeria (WHO, 2024:96) and had been found in 10 new sites in Kenya in 2023 and 2024 (WHO, 2024:96). Evidence-based maps predict a high probability of presence within many urban cities across Africa (Sinka et al, 2020). If *An. stephensi* breaks out from eastern Ethiopia into large cities the region could face malaria outbreaks of unprecedented size (Takken and Lindsay, 2019).

4.5. What are the Policy Implications of Moving towards Malaria Elimination in Zanzibar?

"It is a mistake to judge the return on malaria investments in relation to the current burden of malaria. A facile weighting of the millions invested in malaria interventions against a few remaining cases produces the erroneous conclusion that those funds are achieving little. The true value of these investments is the number of deaths and cases that are prevented, not that remain." (Smith et al, 2010:1385)

The global malaria community is focused on elimination. In 2020 RBM launched new global targets, by 2025 to reduce the incidence and mortality rates of malaria by at least 75 per cent compared with 2015; to prevent the re-emergence of malaria in countries that were malaria-free in 2015; and to eliminate Malaria in a further 20 countries compared to 2015 (RBM, 2020:14). By 2030 RBM target the reduction of malaria incidence and mortality rates by at least 90 per cent compared with 2015 levels; eliminate malaria in a further 35 countries compared to 2015; and to prevent the re-emergence of malaria in all malaria-free countries (RBM, 2020:14). This progressive effort to achieve complete elimination is feasible. Of the 93 countries that were malaria endemic in 2015, eight countries have been certified by the WHO as malaria free since 2015: Algeria, Azerbaijan, Belize, Cabo Verde, China, El Salvador, Sri

Lanka and Tajikistan (WHO, 2024:30). The definition of 'elimination' is very demanding. WHO certification is awarded when a country or territory can prove that the mosquito-borne transmission chain has been interrupted nationwide resulting in zero indigenous malaria cases for at least 3 consecutive years. The country is also required to have a programme in place for preventing the re-establishment of transmission (WHO, 2024:42). Should Zanzibar focus on the very demanding requirements for elimination or focus on the less demanding challenge of eradicating deaths from malaria? 30 countries that were malaria endemic in 2015 were reporting zero malaria deaths in 2023 (WHO, 2024:31). This would require a focus on targeted interventions towards high risk and vulnerable populations and a switch from malaria case and vector management to malaria surveillance and response.

Even once Zanzibar has established a goal there needs to be careful thinking about the best means to achieve that goal.

Should Zanzibar continue to disseminate traditional anti-malaria technologies whose usage has already reached very high levels? By 2023, 73% of households in sub-Saharan Africa had at least one ITN, increasing from about 5% in 2000. The percentage of children under 5 years sleeping under an ITN increased from 2% in 2000 to 52% 2023 (WHO, 2024:76). In 2023 Tanzania received delivery of almost 19 million bed-nets (WHO, 2024:74). Globally, 4.4 billion rapid diagnostic tests (RDTs) for malaria were sold by manufacturers between 2010 and 2023, with more than 82% of sales in sub-Saharan African countries (WHO, 2024:81).

Each technology needs to be carefully evaluated for its efficacy in the Zanzibari context. Some technologies are working less well in the low-malaria environment of Zanzibar. Reactive case detection (RCD) is a commonly used strategy for malaria surveillance and response in elimination settings. Many approaches to RCD assume detectable infections are clustered within and around homes of passively detected cases. This has guided subsequent testing and treatment efforts (Stucka et al, 2020). This method is less useful today in Zanzibar. Data collected by Zanzibar's Malaria Case Notification (MCN) system shows that more than 40% of cases had a travel history outside Zanzibar in the month prior to testing positive for malaria. Out of 387 shehias (wards), 79 (20.4%) were identified as malaria hotspots in any given year (Bisanzio et al, 2023). One study used mobile phone usage data and ferry traffic between Zanzibar and mainland Tanzania and found that local transmission was too low to sustain transmission in most places (Le Menach et al, 2011). This was confirmed by another study which showed that in the absence of imported cases from mainland Tanzania, malaria would likely cease to persist on Zanzibar (Dasa et al, 2022). Malaria infections in Zanzibar largely result from imported malaria and subsequent transmission. Improving control requires quantifying malaria importation rates, identifying high-risk travellers, and assessing onwards transmission (Le Menach et al, 2011). Despite being certified malaria free in 2012, between 2013 and 2023 a survey identified 532 cases of imported malaria into Sri Lanka, mostly Sri Lankan nationals returning from Africa (Dharmawardena et al, 2015). The examples of Zanzibar and Sri Lanka demonstrate that the risk of a malaria resurgence is high and that surveillance and response system needs to be sustained until the wider travel region is free of malaria (Karunasena et al, 2019). Mass screening and treatment (MSAT) may help reduce the reservoir of infection; however, it is unclear whether rapid diagnostic tests (RDTs) detect a sufficient proportion of low-density infections to influence subsequent transmission (Cook et al, 2015).

Should Zanzibar adopt the new anti-malarial technologies that are becoming available? Since 2019, Ghana, Kenya and Malawi have been delivering malaria vaccine, through their respective

routine child immunization programmes to children from 5 months of age. Between 2019 and 2023, more than 6 million vaccine doses were delivered, reaching about 2 million children (WHO, 2024:86). In December 2023, WHO added R21 to its list of prequalified vaccines (WHO, 2024:4). A new ITN with dual active ingredients was trialled (by a consortium comprising the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) and Unitaid) between 2019 and 2022. The trials found the new ITN improved malaria control by 20–50% compared with standard pyrethroid-only nets (WHO, 2024:4). In 2023 20% (nearly 40 million) of the near 200 million bed-nets delivered to SSA were dual active ingredient ITNs (WHO, 2024:74). During 2023 seasonal malaria chemoprevention (SMC) was being implemented across sub-Saharan Africa to 53 million children (WHO, 2024:78).

Zanzibar needs to ask what finance is available to support any of these alternative or complementary strategies. There does exist donor support for many of these technologies. Total funding for malaria in 2023 was estimated at US$ 4.0 billion, showing a slight decrease from US$ 4.1 billion in 2022. However, this represents an increase from US$ 3.5 billion in 2021 and US$ 3.3 billion in 2020 (WHO, 2024:61). In 2024 Ghana, Kenya, and Malawi were offering the new malaria vaccine with support from Gavi, the Vaccine Alliance (Gavi), WHO and other partners (WHO, 2024:4).

The JEE in Zanzibar conducted by the WHO found that “Zanzibar has access to financial resources for the routine implementation of IHR capacities, and financial resources are available that can be accessed on time and distributed for readiness and response to public health emergencies” (WHO, 2023:11). Zanzibar is well placed to adopt the malaria vaccine. As noted by the JEE, “In order to have a sustainable supply of vaccines, the United Republic of Tanzania–Zanzibar has been progressively increasing the annual budget quota for procurement of Gavi co-financing of vaccines from US$ 534,782 in the 2020–2021 financial year to US$ 782,608 in 2022–2023. Government funds are available for procurement of vaccines through ring-fenced funds at the Ministry of Finance.” (WHO, 2023:28-30). The structural infrastructure is likewise in place to ramp up coverage of the malaria vaccine “The central vaccine store is currently equipped with walk-in-cold rooms and freezers. The Government of Zanzibar, with the support of Gavi co-financing, has procured solar direct drive refrigerators as a backup system at district levels. All district vaccine stores are currently equipped with electric refrigerators. Availability of partners in immunization plays an enormous role in improving access to quality immunization services at all levels.” (WHO, 2023:28-30). Also “Systems are also in place to reach marginalized populations using the Reach Every Child strategy and vaccine delivery has been tested through a nationwide measles mass vaccination campaign.” (WHO, 2023:28-30).

There are concerns that cost of new malaria technology is running ahead of the capacity of Zanzibar and other countries to raise the funds to utilize it. While global support exists it is no longer enough. The Strategic Plan for 2021-2025 from the Roll Back Malaria Partnership explains, “Funding for the global malaria response has plateaued since 2010, falling at least US$2.6 billion short per year of the total amount necessary to provide all those at risk with the life-saving malaria tools they need. At the same time, new challenges – including emerging drug and insecticide resistance, increasing population movement, and rising cases in the highest burden countries – mean we must invest even more in researching, developing and scaling up essential tools” (Roll Back Malaria Partnership, 2020:10). Despite the 2023 investment reaching US$ 4.0 billion, this falls short of the estimated US$ 8.3 billion needed globally to meet the GTS targets by 2023. The funding gap has widened over the past 5 years, increasing from US$ 2.6 billion in 2019 to US$ 4.3 billion in 2023, meaning that only 48% of the required

funding (WHO, 2024:62). The health budget in Zanzibar increased from $31.7 million in 2017-18 to $117.3 million in 2022-23, and that portion specifically allocated to malaria remained less than 1% of the total (Ali et al, 2023).

4.6. Will Malaria become an Urban Phenomenon in Zanzibar?

The future of densely populated Zanzibar is very much urban[4]. Long held assumptions about urbanisation and malaria need re-thinking. In the early 2000s it was noted that the "risk of malaria transmission is qualitatively much greater in rural than urban areas" (Byrne, 2007). While malaria did occur in urban Africa, it was concentrated in the city periphery where small-scale commercial gardens collected surface water (Takken and Lindsay, 2019). There were some concerns as both the rapid growth of urban populations and the trend of urban-only tourism would likely require attention to malaria in African cities (Byrne, 2007). But the wider thinking was optimistic, that the rapid urbanisation of Africa would "reduce malaria transmission" (De Silva and Marshall, 2012), where malaria is "uniquely amenable to prevention and control" (Malaria Knowledge Programme, 2004), through for example "the destruction of aquatic habitats of mosquitoes and expanded access to health care" (WHO, 2022b). Urban malaria goes this view could be subsumed by a more general concern with poverty. WHO data from SSA reveal that malaria prevalence among children aged under 5 years is disproportionately highest among households living in poverty and decreases with rising economic status, highlighting that wealth strongly influences malaria risk (WHO, 2024:100). The poorest urban dwellers suffer a double burden of insufficient protection from malaria transmission due to inadequate housing and living conditions, and limited financial resources (Malaria Knowledge Programme, 2004). People in low-income households frequently lack the financial means to implement mosquito-proofing measures, making them more vulnerable to mosquito bites at night (WHO, 2024:100).

This urban ambivalence needs re-thinking. A worrying trend was seen in the adaptation of malaria vector species to the urban environment (De Silva and Marshall, 2012). Unlike other malaria vectors in Africa, *An. stephensi* mosquitoes are found not only in rural areas but also in cities, where they breed in human created water containers, such as household water storage containers and garden reservoirs (Takken and Lindsay, 2019). In the context of rapid urbanisation and the emergence of a new urban mosquito malaria control cannot be subsumed into a concern with poverty but needs to be tackled directly. One way is through the construction and design of houses. The WHO recognises this and has created a new 'Global framework for the response to malaria in urban settings' which the WHO declares is "designed to provide guidance to city leaders, health programmers and urban planners as they work to control and eliminate malaria in a rapidly urbanizing world". The framework was developed in collaboration with UN-Habitat (WHO, 2022b).

There have been a flood of studies that find a lower incidence of malaria in high-quality modern-build urban houses (with metal roofs and brick or concrete walls), in Swaziland between 2012 and 2015 (Dlamini et al, 2017); across 21 African countries using data from almost 140,000 children between 2008 and 2015 even after accounting for differences in levels of urbanisation, wealth, and use of malaria interventions (Tusting et al, 2017); across 72 randomly selected houses in Tanzania on a monthly basis between 2008 and 2011 utilising a detailed study of housing characteristics (eave gaps, wall types, roof types, number of windows,

[4] In Zanzibar the population of Stone Town (800,000) is growing rapidly as are several urbanized tourist hubs. The second main island, Pemba is much less urbanized.

rooms and doors, window screens, house size) (Lwetoijera et al, 2013); a study in the city of Yaounde, Cameroon across 467 randomly selected houses across 32 districts which collected 168,039 mosquitos that found opened eaves, the high number of windows, the presence of holes in walls and living close to breeding sites were associated with high densities of mosquitoes indoor (Ngadjeu et al 2020); a representative sample in 2015 of 8148 households in 329 clusters in Nigeria covering Children aged 6–59 months found an increased prevalence of malaria in houses built completely with unimproved materials (Morakinyo et al, 2018).

Good quality modern housing protects against malaria regardless of the malaria transmission settings (Nawa et al, 2024). The implications are that urban malaria control needs to focus on the design, maintenance, and construction of housing (Tusting et al, 2015) and that housing improvements may offer an attractive and sustainable additional strategy to support countries in malaria elimination (Dlamini et al, 2017).

Housing is not the only urban risk factor. Review studies have identified a host of risk factors that differ from rural areas including travel history, hotter urban temperatures, more crowded exposure to livestock, proximity to water sources, piped water, and drainage systems (Merga et al, 2015; WHO, 2022b). There is also a need for better targeted data to determine whether cases diagnosed in urban areas were imported from surrounding rural areas or resulted from transmission within the urban area. If infections are being acquired within urban areas, malaria control measures must be targeted within those urban areas to be effective (Wilson et al, 2015). This indicates that in future malaria policy needs to be a multi-sectoral engagement to control urban malaria, including environmental management, improved diagnostics and treatment, socio-economic interventions, and better urban planning (Merga et al, 2025).

5. Conclusion

This paper focuses on the case study of Zanzibar where efforts to eliminate malaria were a globally important success. The incidence of malaria fell faster than elsewhere, despite the island being a tourist destination and having exposure to resurgent malaria in mainland Tanzania. This paper focuses on asking six big questions and justifying why those answers are important for Zanzibar. In one case the paper does provide an answer. Looking back, why did malaria decline? The paper makes a case that the decline was primarily due to sustained and successful efforts led by the government of Zanzibar in partnership with the global malaria community. More research is still needed here, to engage with those who were responsible for the public health intervention, the politicians who committed the government to a two-decade long intervention, the medical and public health professionals who implement the intervention, the global donor community who supported it, and even the local community in Zanzibar who were the subjects of that intervention. This research would be even more valuable given that there has been little if any effort to answer another question. What are the lessons for Zanzibar and elsewhere regarding this public health success story? Here the paper touched on a puzzle; both the government of Zanzibar and the global public health community are surprisingly quiet about this public health triumph. Looking forward what will the economic benefits be to Zanzibar of this public health success story? The paper reported the wealth of economic evidence produced by Jeffrey Sachs and others attempting to quantify the economic costs of malaria in the 1990s. This empirical work needs to be revived to think about the economic benefits of the near elimination of malaria in Zanzibar and elsewhere.

The political rationale is obvious in Vision 2050 from Zanzibar and similar planning documents elsewhere in Africa that contain ambitious targets for economic growth over the next few decades. The final three questions were closely related. On the one hand there is a real risk of a malaria resurgence in Zanzibar resulting from the new urban mosquito species, imported malaria, and a slacking of the political and medical attention to diagnosing, treating, and controlling malaria. Doing nothing is not an option. But what should Zanzibar do? Should Zanzibar pursue the very demanding task of complete indigenous malaria elimination or the less challenging one of eradicating deaths from malaria? There are big questions about choice of intervention method, push further the utilisation of existing anti-malaria technology or else adopt elements of or the entire package of new (and expensive) malaria technologies where Zanzibar will run into real resource constraints. The dependence on external resources needs to be reduced by more domestic funding, public-private partnerships, and multi-sectoral engagement. Malaria is an economic issue so should be part of thinking from the Ministry of Finance. Any intervention method must now encompass the urban sector, including everything from case detection to the design and construction of housing. While presented separately these questions cannot be considered separately. For example the risk of a revival in malaria and the economic benefits of sustaining low rates of malaria are important inputs into any business case for investing in existing and (expensive) new anti-malaria technologies to continue the push for malaria elimination

This paper concludes with a big picture idea, that thinking about malaria in Zanzibar requires moving away from a dominant paradigm in global and Zanzibar thinking, the centrality of institutions, towards a focus on health as both an input into and a crucial outcome of the process of economic development.

In the early 1990s, the World Bank explained the relative economic failure of many African economies over the past few decades: “The main factors behind the stagnation and decline were poor policies – both macroeconomic and sectoral – emanating from a development paradigm that gave the state a prominent role in production and regulating economic activity” (World Bank, 1994:20). Despite substantial policy reform in the 1980s and 1990s, there was no apparent economic revival. Policy reforms, they argued, weren’t generating good economic outcomes because they were implemented in a context of ‘bad governance’. The World Bank and IMF shifted attention from good policy to good governance, which included aspects related to the functioning of government administration–transparency, accountability, fairness, participation, and ownership–and to those impacting economic transactions, such as the registration, protection, and tradability of property rights (Meisel and Aoudia, 2008). Consequently, the development debate became tightly focused on the role of good governance and institutions.

The focus on good governance and institutions is clearly reflected in Zanzibar, where Vision 2050 was structured around four pillars. Of those four, three were related to “good policy”: economic transformation (industry, trade, tourism, blue economy, oil and gas, creative and digital economy, finance and investment); infrastructure (housing, transport, seaports, airports, energy, ICT); and social welfare (education, health, sanitation, social protection, heritage and sports). Good policy is defined in a conventional manner throughout, as making markets work better, improving incentives, allocating resources more efficiently, boosting investment, and increasing exports. The final pillar is good governance, which provides the context to ensure that good policy leads to economic success. Good governance in Zanzibar is discussed in globally conventional terms,

“The RGoZ has consistently acknowledged the role of good governance in facilitating development in its previous national plans. The establishment of an accountable, transparent, responsive and effective system of governance that is resilient to developmental pressures cannot be emphasised enough” (RGZ, 2020:58).

Jeffrey Sachs wrote that this conventional set up of good policy being framed by good governance left the development debate “dangerously simplified”; if the economy was performing poorly and efforts to implement good policy were not generating desired economic outcomes, the blame could always be placed on the governance or institutional framework (Sachs, 2023). The implication of this debate has been to distract attention from the undoubted success of the campaign to near-eliminate malaria in Zanzibar and the likely economic benefits. In thinking about economic development in the years to 2050, Zanzibar remains committed to this “dangerous simplification” whereby good policy in a framework of good governance are the only objectives that a government needs to focus on.

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