



Keeping Malaria Out of Zanzibar

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Executive Summary

In November 2007, Africa Fighting Malaria (AFM) visited Zanzibar to document the islands' progress in controlling malaria. In this report, we briefly describe the history of malaria control on Zanzibar and track the progression of the current program, which has successfully managed to bring the disease under control. The lessons learned and challenges ahead for Zanzibar provide an excellent case study of the appropriate policies for other island nations and countries seeking to control and eliminate malaria.

Zanzibar has a long history of malaria control and benefited from a highly effective control program in the 1960s. Unfortunately this program was abandoned in 1968. The disease subsequently returned to the islands, and by the 1980s was once again the number one killer of children. In 2003, the Government of Zanzibar changed treatment policies from chloroquine, which was failing in 60 percent of cases, to artemisinin-based combination therapies (ACTs). It also initiated indoor residual spraying programs (IRS) and distributed insecticide-treated nets (ITNs) to pregnant women and children under 5 years of age. These interventions dramatically reduced the burden of malaria – parasite prevalence on the islands is now below 1 percent.

Zanzibar's success in controlling malaria presents some new challenges. For example, presumptive treatment of fever with anti-malarials, a strategy broadly applied in endemic settings, must be revised in Zanzibar's case. Fever cases among both adults and children are no longer likely to be caused by malaria. Malaria scientists now must decide how best to take the malaria control program forward, how to detect malaria epidemics and respond to them. Perhaps most important of all, scientists, malaria control program officers and donors need to find the most appropriate way to sustain the program and keep Zanzibar malaria-free. The island should be able to eliminate malaria with the existing set of vector control tools and treatments. However, in order to achieve elimination, it is incumbent on Zanzibar's political leaders to prioritize malaria control and to work constructively with malaria scientists to implement the best possible range of strategies. Malaria could return to these islands via trade routes and claim the lives of people who have lost natural immunity to the disease. If history is any guide, the long-term success of malaria control depends on Zanzibar's capacity to grow economically and create wealth for its inhabitants.

1. Introduction

Zanzibar is an autonomous state consisting of two large islands Unguja and Pemba, and several smaller islands all of which are located off the north-eastern coast of the Tanzania mainland. The southern island Unguja (or Zanzibar as it is commonly referred to) has a land area of approximately 1,658km² and the northern island of Pemba has a land area of approximately 984km². According to the latest population census data, the combined population of the two islands is approximately 1.1 million.¹ Zanzibar gained independence from Britain in 1963 and merged in 1964 with Tanganyika to establish the United Republic of Tanzania. Despite being declared a Union, Zanzibar was not fully integrated. The Government of Zanzibar has retained

¹ Government of Tanzania (2003). "2002 Population and Housing Census, General Report," Central Census Office, National Bureau of Statistics, President's Office, Planning and Privatization, Dar-es-Salaam.

virtually all government functions on the islands and the Zanzibar Malaria Control Program (ZMCP) is independent of mainland Tanzania's national malaria control program.²

Tourism has surpassed agriculture as the island's principal source of revenue. According to the Zanzibar Commission for Tourism, the tourism sector accounts for over one-fifth of Gross Domestic Product (GDP), which equates to approximately TSH 512.4 billion (US\$410 million).³ The average household consists of five to six people and three to four rooms. Housing construction material are predominantly natural (wood, reed and grass) in rural areas and western-style materials (bricks and cement) in urban and peri-urban areas. GDP per capita is estimated at US\$250 and the level of unemployment at 17 percent.⁴ Zanzibar's GDP per capita equates to less than half the average GDP per capita for sub-Saharan Africa (US\$523), but close to the Tanzanian mainland average of US\$259.⁵

Zanzibar is situated a few degrees south of the equator. Its tropical climate is characterized by hot humid weather, with the hottest weather generally occurring from December to March. During this time, the Islands experience short rains that typically only last a few hours. The main rainy season occurs from April to June when the long monsoon rains occur. These conditions are ideal for *Anopheles* mosquito breeding, the vectors that transmit malaria.

In June 2005, Tanzania and the islands of Zanzibar were selected to join the newly formed US President's Malaria Initiative (PMI). On Zanzibar's two main islands, the PMI activities were to build on some successes already achieved by the Zanzibar Malaria Control Program (ZMCP) in improving access to ACTs and ITNs. In addition, the PMI additionally supported IRS to provide the most comprehensive approach to controlling malaria on the islands.

2. Zanzibar's Malaria Eradication Campaign

Malaria has been a leading health problem on Zanzibar for the past half century. On the two islands of Zanzibar, the disease is characterized by perennial stable transmission, with *Anopheles Gambiae* the dominant vector⁶ and *Plasmodium falciparum* the principal parasite. Zanzibar mounted its first full-scale malaria control program in 1958.⁷ The effort was a collaboration between the Government of Zanzibar, the World Health Organization (WHO) and the United Nations Children's Fund.⁸ A variety of control measures were implemented, including IRS, malaria chemotherapy, chemoprophylaxis and larvaciding in urban areas.⁹ The program was subsequently expanded between 1961 and 1968 in conjunction with the WHO's global malaria

² For an in-depth history of Zanzibar see: <http://www.allaboutzanzibar.com/indepth/history/id-01-01-01-01.htm>

³ "Z'bar tourism grows at 9 pc," The Citizen (Dar es Salaam), December 20, 2007. Available: <http://www.thecitizen.co.tz/newz.php?id=1960>

⁴ Zanzibar Investment Promotion Agency (2004) Zanzibar Investment Report. Available at: http://www.bot-tz.org/Publications/TZInvestmentReports/Zanzibar_Investment_Report.pdf

⁵ World Bank (2006) Africa Development Indicators. Washington, D.C.

⁶ *An. Funestus*, *An. Coustani*, *An. Arabiensis*, *An. Merus*, *An. Nili*, *An. Paludis* and *An. Pharoensis* are malaria vectors that also occur on Zanzibar.

⁷ USAID/Tanzania (1983) Report of the Evaluation of the USAID Zanzibar Malaria Control Project.

⁸ Ibid.

⁹ Correspondence with Dr. Abdullah Ali, Zanzibar Malaria Control Program Manager, November 15, 2007.

eradication campaign.¹⁰ Though these agencies failed to eradicate malaria, they registered great success by reducing the prevalence rate to 7.8 percent in Unguja and 1.7 percent in Pemba.¹¹ By 1968, malaria was no longer considered a health problem and the program was abandoned.¹² The folly of this decision soon became evident as malaria re-emerged as a major public health concern. By 1973, prevalence rates had increased to 54 percent in Unguja and 10 percent in Pemba.¹³

The next major attempt to control malaria began in September 1981. This joint initiative between the US Agency for International Development (USAID) and the ZMCP was initially given a five-year lifespan but later extended to 1987.¹⁴ According to Barbiero et al. (1990), the purpose of the initial project design and subsequent amendment was, “to reduce the prevalence of malaria on Zanzibar to a level at which it no longer constitutes a major health problem...in such a way that the Government of Zanzibar will be able to maintain effective control with its own resources.”¹⁵

However, “This purpose may have been too robust given the time frame of the project and the difficulty in implementing and sustaining the projects priority interventions (i.e. domiciliary spraying, source reduction, larviciding, and Ultra Low Volume Spraying)”. Indeed, it seems that too much was expected in too short a time. In addition to these constraints, Barbiero et al. also noted that increasing resistance to chloroquine, then the first-line prophylaxis and treatment, was hampering control efforts. The project was also initiated without a dedicated vector control specialist; instead short-term specialists were hired as consultants to assist the ZMCP. Unfortunately, this complicated the coordination and implementation of the project.

Further, the principal intervention, IRS, was hampered by logistical problems and a general lack of coordination. IRS depends upon good supply chain management of insecticides and equipment, well-trained spray operators, and good oversight and supervision to ensure a high proportion of dwellings are sprayed. Yet the program reportedly suffered irregular supplies of insecticide and fuel, insufficient supervision of spray operators, and low levels of public compliance which reduced coverage levels. Insecticide resistance¹⁶ and drug resistance further

¹⁰ Pletsch DJ, Schloming HR (1986) Zanzibar Malaria Control Project External Review. Vector Biology and Control Project.

¹¹ Minjas JN, Schaefer CH and Tonn RJ (1988) Malaria control in Zanzibar: Appraisal of present conditions, discussions of alternatives. Vector Biology and Control Project.

¹² Similar experiences have been recorded in other countries that achieved impressive results in controlling malaria only to have it return once control measures ceased. In 1969 the World Health Organization downgraded its global malaria eradication program to a malaria control program.

¹³ Ibid.

¹⁴ Barbiero VK, DeGorges A, Minjas JN and Tonn RJ (1990) Project Completion Report: Zanzibar Malaria Control Project.

¹⁵ Ibid.

¹⁶ According to the WHO, insecticide resistance to DDT hampered malaria control in Zanzibar. (see WHO Afro, 2007, “Implementation of Indoor Residual Spraying of Insecticides for Malaria Control in the WHO African Region.” World Health Organization for Africa, p. 47. Available at:

http://www.afro.who.int/vbc/reports/report_on_the_implementation_of_irs_in_the_african_region_2007.pdf) AFM would however remind readers that field and laboratory evidence confirms that DDT’s primary action in vector control is as a spatial repellent, stopping mosquitoes from ever entering houses. This means that even in the presence of toxic resistance to DDT, the insecticide will remain an effective because of its powerful spatial repellence actions. See Grieco J et al. (2007) “A new classification system for the actions of IRS chemicals

hampered progress, as did poor communication between USAID, ZMCP and other health ministries on the island. This resulted, among other failings, in the ZMCP procuring agricultural insecticides unsuitable for IRS.¹⁷ Little effort was made to undertake baseline surveys of disease prevalence, which made it difficult for public health officials to monitor progress and adapt strategies based on evidence. After eight years, the project was deemed unsuccessful and ultimately terminated.

3. Malaria Under Control Again

Until recently, malaria remained Zanzibar’s number one public health problem. In 2003, malaria accounted for 43 percent of all outpatient consultations and ranked first among diseases in terms of both morbidity and mortality in health facilities.¹⁸

Zanzibar has a relatively well developed public health system. Public healthcare on the islands is provided at three levels. At the primary level, there are three types of health facilities (first-line primary healthcare units, second-line primary healthcare units and primary healthcare centers or cottage hospitals) located in or near the community. The secondary level comprises the district hospitals, the types of facilities that are currently found mainly on Pemba Island. The Zanzibar Ministry of Health and Social Welfare plans to also establish such facilities on Unguja.¹⁹ The tertiary level comprises the consultant or referral hospitals and some specialized institutions (Table 1). Overall, the Government of Zanzibar estimates that 90 percent of the population lives within 10 kilometers of a health facility.

Table 1: Number and type of health facilities on the two main islands

Type	Unguja	Pemba
Referral hospital	1	0
District hospital	0	3
Other specialized institutions (hospitals)	2	0
Primary health care centers	2	2
2 nd line PHCUs	18	8
1 st line PHCUs	51	46
Private hospitals	3	0
Private healthcare units / dispensaries	65	9

Source: Ministry of Health and Social Welfare – Zanzibar, 2007

This healthcare infrastructure facilitated the wholesale malaria treatment policy change undertaken in September 2003. With resources from the African Development Bank, Zanzibar

traditionally used for malaria control” PLOS One, available at:

<http://www.plosone.org/article/info:doi%2F10.1371%2Fjournal.pone.0000716>

¹⁷ Barbiero et al. (1990) explained that “At the outset of the project 70 tons of malathion, 25% EC were mistakenly purchased by the GOZ as part of their contribution to the ZMCP. This concentration of malathion is suitable only for agricultural purposes, 50% EC being required for wall spraying to control mosquitoes.” Ibid. p. 11

¹⁸ Tanzania National Bureau of Statistics and ORC Macro (2005) “Tanzania Demographic and Health Survey 2004-05: Key Findings for Zanzibar,” Calverton, Maryland, USA.

¹⁹ Ministry of Health and Social Welfare (2007) Assessing the potential for elimination – Zanzibar Strategic Plan for Malaria Control 2007-2012 Draft document.

moved from chloroquine, which registered 60 percent treatment failure, to ACTs.²⁰ Artesunate/amodiaquine blister packs were procured through the WHO for first-line treatment of malaria. Artemether/lumefantrine fixed-dose combination packs were stocked for second-line treatment.²¹ The new treatments were supplied to all public health facilities and administered free of charge to patients with confirmed malaria. To facilitate this policy change, rapid diagnostic tests (RDTs) were piloted in Zanzibar in 2005 under a joint program of the ZMCP, the WHO, Medecins Sans Frontiers, and the Karolinska Institute through its Zanzibar Malaria Research Unit. In 2007, the Government of Zanzibar implemented a policy of administering an RDT to anyone over age five suspected of having malaria.

In addition to funding from the African Development Bank, the Global Fund to Fight Aids, TB and Malaria has provided a significant amount of financial support for malaria control in Zanzibar. A grant of US\$1,153,080 was awarded and disbursed under Round 1 in June 2003 to assist Zanzibar in implementing a new treatment policy using ACTs.²² A further US\$8,438,788 was awarded under Round 4 in January 2005 to continue support of the new treatment policy and scale-up coverage of ITNs.²³ To date, US\$5,270,954 of the Round 4 grant has been disbursed.²⁴ According to Dr Ali, “Most of this funding has been used for the implementation of a new national antimalarial treatment policy and to scale-up ITN coverage”.²⁵

The US President’s Malaria Initiative (PMI) provided 100,000 RDTs for public health facilities through 2007.²⁶ A recently completed survey showed that almost 95 percent of facilities in Zanzibar had either microscopy or RDTs available for confirming malaria diagnoses.²⁷

In line with the Abuja promises,²⁸ the Government of Zanzibar removed tariffs on publicly and privately procured ITNs. According to ZMCP data, by 2007, 76 percent of households owned at least one conventional ITN or long-lasting insecticidal net (LLIN).²⁹ Between 2002 and 2005, the combination of free ACTs and ITNs reduced malaria-related deaths among children under

²⁰ Bhattarai A, Ali AS, Kachur SP, Martensson A, Abbas AK, et al. (2007) Impact of artemisinin-based combination therapy and insecticide-treated nets on malaria burden in Zanzibar. *PLoS Med* 4(11): e309.

²¹ Ibid.

²² The Global Fund to Fight AIDS, TB and Malaria, Zanzibar (Tanzania), Malaria – Round 1 Grant in Detail. Available at:

<http://www.theglobalfund.org/programs/grantdetails.aspx?compid=571&grantid=49&lang=en&CountryId=ZAN>

²³ The Global Fund to Fight AIDS, TB and Malaria, Zanzibar (Tanzania), Malaria – Round 4 Grant in Detail. Available at:

<http://www.theglobalfund.org/programs/grantdetails.aspx?compid=822&grantid=317&lang=en&CountryId=ZAN>

²⁴ Ibid.

²⁵ Correspondence with Dr. Abdullah Ali, Zanzibar Malaria Control Program Manager, November 15, 2007.

²⁶ Correspondence with Dr Rene Salgado, PMI, Tanzania, December 19, 2007.

²⁷ President’s Malaria Initiative “FY08 Malaria Operational Plan, Tanzania.” November 9, 2007, USAID, Washington DC. Available at http://www.fightingmalaria.gov/countries/tanzania_mop-fy08.pdf.

²⁸ The Abuja Declaration and Plan of Action, The African Summit on Roll Back Malaria, April 2000, Nigeria. Available: http://www.rbm.who.int/docs/abuja_declaration_final.htm

²⁹ Zanzibar National Malaria Control Program (2007) “Zanzibar: Overcoming Challenges to Maintain SUFI” Presentation to East African Regional Network (EARN), November 20-22, 2007. Presentation available at: <http://www.rbm.who.int/countryaction/docs/earn/7eam2007Zanzibar.ppt#256,1,Zanzibar>

age five by 75 percent.³⁰ The distribution of LLINs in 2006 helped reduce malaria parasite prevalence in the population ten-fold.³¹

The Fiscal Year 2008 PMI budget for Tanzania is US\$34 million. The mainland accounts for the vast majority of this budget with US\$29.482 million. US\$2.783 million of the total is allocated for Zanzibar. The remainder of the budget is allocated for monitoring and evaluation, administration and other expenses. The commodity portion of the total budget is 51 percent. Of the total allocated, 45 percent is for LLINs, 20 percent is for IRS, 17 percent for diagnostics, procurement and use of antimalarial drugs, eight percent for Intermittent Preventive Treatment in pregnancy, four percent for monitoring and evaluation, two percent for capacity building and 4 percent for management and administration. The malaria control per capita expenditure is US\$0.80. Approximately US\$12.815 million, or 38 percent, will be channeled through non-governmental and faith-based organizations.³²

Indoor Residual Spraying (IRS)

The PMI provided funding and technical assistance to the Government of Zanzibar in 2006 to supplement the existing ITN and treatment efforts with a comprehensive IRS program. There have been three spray rounds since 2006, with the first spray round extending from July to September 2006 and the second round in March 2007. The first two rounds in Zanzibar reached 203,754 and 196,978 households, accounting for 96 and 93 percent of the targeted households respectively. The third round of IRS extended from July to September 2007 with similar results.

In all three spray campaigns, the insecticide lambda cyhalothrin (Icon-CS[®]) was used. Spray operators were trained for two weeks on personal protection against malaria, insecticide mixing and application, pump maintenance and safe transportation and storage of insecticides. Both men and woman were recruited and trained as spray operators. Community leaders were directly involved in sensitizing local populations. The only locality that is not sprayed is Stone Town because entomological surveys found few *Anopheles* mosquitoes in this urban area.³³ Nevertheless targeted larvaciding is conducted to control mosquito larvae.³⁴ The PMI plans to continue to support IRS in Zanzibar with focal spraying depending on epidemiological and entomological data.³⁵

The ZMCP in collaboration with PMI recently completed a survey of outpatient registers covering the first six months of 2005, 2006, and 2007 at 10 health facilities in Unguja and Pemba.³⁶ Compared to 2005 data, laboratory-confirmed malaria among children under age one was 70 and 90 percent lower for 2006 and 2007, respectively. According to the PMI, the main

³⁰ Bhattarai A, Ali AS, Kachur SP, Martensson A, Abbas AK, et al. (2007) Impact of artemisinin-based combination therapy and insecticide-treated nets on malaria burden in Zanzibar. *PLoS Med* 4(11): e309.

³¹ Ibid.

³² President's Malaria Initiative "FY08 Malaria Operational Plan, Tanzania." November 9, 2007, USAID, Washington DC. Available at http://www.fightingmalaria.gov/countries/tanzania_mop-fy08.pdf.

³³ Correspondence with Dr. Abdullah Ali, Zanzibar Malaria Control Program Manager.

³⁴ Ibid.

³⁵ President's Malaria Initiative "FY08 Malaria Operational Plan, Tanzania." November 9, 2007, USAID, Washington DC. Available at http://www.fightingmalaria.gov/countries/tanzania_mop-fy08.pdf.

³⁶ Ibid.

difference between the first six months of 2005 and the first six months of 2006 was the free distribution of LLINs to all pregnant women and children under age five.³⁷

The PMI also notes that population-based parasitological data from Zanzibar show important declines. Data from an on-going study by the Zanzibar Research Unit and the Karolinska Institute report that in two sentinel sites (North A and Micheweni Districts in the main Zanzibari island of Unguja) the prevalence of malaria infection was reduced from 7.9 percent in 2003 to 0.8 percent in 2006 in North A and from 14.2 percent in 2003 to 4.7 percent in 2006 in Micheweni. Preliminary 2007 data from the same sites report prevalence close to zero.³⁸

*From Holo- To Hypo-Endemicity*³⁹

Malaria is well under control again on Zanzibar Islands for the first time since 1968; yet with this success comes new challenges. Lower exposure to *Plasmodium falciparum* in early childhood will reduce natural immunity, making future generations more susceptible to malaria epidemics. The success achieved in Zanzibar has revived debate over how best to maintain control, improve surveillance to guard against future epidemics and ensure that holoendemic malaria does not re-emerge in Zanzibar as it did in the 1970s.

Complacency among both malarial country governments and donors is an unfortunate reality which local activists and the private sector should guard against. Zanzibar remains heavily dependent on external funding for its malaria control funding and for most other healthcare programs.⁴⁰ Despite the increase in tourism revenues, Zanzibar's GDP per capita remains relatively low. A significant increase in income will enable individuals to seek medical attention and improve their living standards, as well as ensure public health programs are sustainable.

A consortium of key officers is developing an epidemic surveillance protocol for malaria, including a case reporting system whereby all health facilities relay information about malaria episodes to district levels and the ZMCP on a weekly basis. Not every health facility is in cell phone range, but the ZMCP intends to use text messaging to relay data from field to district health facilities.

There is widespread agreement that the WHO's Integrated Management of Childhood Illnesses guidelines must be adapted to Zanzibar's reduced malaria burden. In endemic areas with a high burden of malaria, according to the guidelines, children with fever in areas of stable transmission are presumptively given antimalarial treatment.⁴¹ In Zanzibar, however, malaria's low

³⁷ Ibid.

³⁸ Ibid.

³⁹ Holoendemic refers to a high level of disease throughout a population in a given area. Hypoendemic refers to low levels of disease transmission in a population but with the threat of epidemics.

⁴⁰ President's Malaria Initiative "FY08 Malaria Operational Plan, Tanzania." November 9, 2007, p. 19 & Correspondence with Guida Rotllant, Karolinska Institute, Zanzibar.

⁴¹ WHO "Model Chapter for Textbooks, Integrated Management of Childhood Illnesses" World Health Organization Department of Child and Adolescent Health and Development (CAH), Geneva, 2001. Available at: http://www.who.int/child-adolescent-health/New_Publications/IMCI/WHO_FCH_CAH_00.40/WHO_FCH_CAH_00.40.pdf

prevalence means that fever is much less likely to be caused by malaria, and healthcare workers will be forced to seek another diagnosis.

It is unclear if Zanzibar has the resources, healthcare infrastructure and capacity to treat and control the illnesses and ‘fevers’ that have routinely been treated as malaria in the past. It is also unclear how and when the islands should return to presumptive treatment of malaria should a malaria epidemic occur in the future. More research and guidance is needed in determining the constitution and scope of a malaria epidemic. The surveillance and response protocol will likely set an arbitrary threshold. Fever surveys will be administered to communities with excess case reports and malaria patients treated with ACTs. In the interim, Zanzibar will likely restrict antimalarial administration to lab-confirmed or RDT-confirmed diagnosis. All public facilities are now stocked with RDTs and health workers are trained in their use.

The successful control of malaria has also presented public health experts and malaria scientists with questions about how to continue with vector control activities. LLINs are expected to replace the IRS program, primarily because cost-effectiveness of intra-domiciliary spraying diminishes with burden. It is not yet clear whether an epidemic response will include focal spraying or will be limited to efforts to rapidly diagnose and treat malaria cases – or if it will be a combination of these interventions.

A voucher system for LLINs is being implemented by the Mennonite Economic Development Associates. In the private sector, LLINs are usually about TSH 7,000 (US\$6.00), but with a voucher from clinics, a pregnant woman or child can obtain a government-subsidized LLIN for TSH 1,000 (US\$0.86). All the health facilities register each of the vouchers and the retailer records all the information about the client. Retailers then use the vouchers to buy LLINs from the manufactures who store all of the nets at the ZMCP offices. Retailers keep TSH 300 (US\$0.26) and bring the remaining TSH 700 (US\$0.60) along with the voucher. Wholesalers pay TSH 400 (US\$0.34) to the Ministry of Health and Social Welfare. Thus far, since the introduction of the voucher system in November 2007, the ZMCP has distributed approximately 8,000 nets.

4. Discussion

AFM field visits and consultations on Zanzibar reflected a highly organized, comprehensive and effective malaria control program. Zanzibar has a well-developed and effective data management system where malaria-related data is housed and analyzed. IRS spray forms are captured and used to calculate spray coverage’s and summary sheets from clinics and hospitals capture malaria cases. But effective data entry must evolve into a rigorous monitoring and evaluation effort. Without weekly reporting and appropriate programmed action, outbreaks will surely become epidemics and families will suffer needlessly.

Sustained vector surveillance will be critical to monitoring and responding to the build-up of insecticide resistance. Through the course of its field visits, AFM found spray cards placed outdoors to tag sprayed houses faded by the sun and rain. This could make follow-up surveys to collect spray data more difficult. Future efforts should locate these tags indoors or in sheltered

areas to guard against exposure to the elements and thus boost monitoring and evaluation capacity.

Despite the significant reductions in malaria, ongoing education campaigns are needed to maintain at the current high acceptance levels of both LLINs and IRS amongst the local communities and must be continued on an annual basis – particularly as people become complacent about the need for vector control.

As malaria prevalence moves closer to zero and Zanzibaris lose their natural immunity to the disease, screening of the general population will become increasingly important. It is likely that in the future most malaria in Zanzibar will be imported by travelers arriving from mainland Tanzania. Little data is currently collected on population migration between the mainland and islands. Serious consideration should be given to conducting random screenings in order to understand better the levels of parasites being introduced from the mainland. However, the respective autonomy of both regions makes this a politically sensitive issue and unlikely to evolve in the near future. Alternatively, patients presenting with malaria on Zanzibar could be profiled for recent travel.

Public-private partnerships in malaria control, such as the Lubombo Spatial Development Initiative where a combination of public and private funding dramatically reduced the burden of malaria in southern Mozambique, have much to offer Zanzibar. Its economy relies heavily on tourism. The significant malaria reductions could be marketed to both local and international tourism stakeholders to attract more tourists to the island of Zanzibar and encourage local companies to share some of the costs of ongoing surveillance and control measures. Tourism operators and companies, for example, could provide ongoing resources to conduct focal spraying as needed.

Zanzibar should look to others that have eliminated malaria through disease control programs and ultimately eradicated the disease through economic growth. Mauritius and Taiwan both eradicated malaria with comprehensive programs based on IRS with DDT and treatment of malaria cases.⁴² But crucially, both islands also instituted economic reforms that ensured that their respective economies grew after malaria was eradicated. According to the Fraser's Institute annual Economic Freedom of the World index, which has captured data on the level and variation of economic freedom across the globe since the mid 1970's, Mauritius and Taiwan have made significant progress in their levels of economic freedom.⁴³

The findings in the report and many other studies unambiguously support the fact that economic freedom is strongly related to prosperity.⁴⁴ History has shown a strong and clear link between

⁴² WHO Afro, 2007, "Implementation of Indoor Residual Spraying of Insecticides for Malaria Control in the WHO African Region." World Health Organization for Africa, p. 30. Available at:

http://www.afro.who.int/vbc/reports/report_on_the_implementation_of_irs_in_the_african_region_2007.pdf

⁴³ One of the key objectives in compiling the index is to establish whether relationships exist between economic freedom and economic wealth.

⁴⁴ Mauritius has improved its world ranking from 55th position in 1980 to 22nd position in 2005. According to the World Bank's African Development Indicators, Mauritius' real GDP per capita has risen from \$1,517 in 1980 to US\$5,212 in 2004.⁴⁴ Taiwan has also improved its level of economic freedom from a rating of 6.5 out of ten in

wealth creation and sustained malaria control. Indeed, recent evidence suggests that overall health outcomes improve with increased openness to trade. Owen and Wu find that, “in general, increased openness is associated with lower rates of infant mortality and higher life expectancies, especially in developing countries”.⁴⁵

Though immigration has brought the odd malaria case back to Mauritius and Taiwan, substantial increases in wealth have helped to sustain surveillance to avert any resurgence in malaria, as well as empower individuals to seek treatment through private outlets as needed. Thus, a key component to the ongoing success of malaria control and potential elimination from Zanzibar will be increased economic freedom and improved economic growth.

According to the World Bank’s Doing Business studies which document the ease of doing business and trading in 178 economies, Tanzania, including Zanzibar, is ranked 130. Difficulties in obtaining licenses, registering property and hiring personnel are considered particularly onerous.⁴⁶ Without much-needed economic reforms that will benefit private businesses and allow entrepreneurs to create wealth, it will be extremely difficult to maintain public health programs such as the successful malaria control program, and secure rising standards of living.

5. Conclusion

Zanzibar’s progress against malaria demonstrates that a comprehensive malaria control strategy backed by solid donor commitment and political leadership can produce impressive results. A key component to Zanzibar’s success has been the good working relationship between the Government of Zanzibar and donors, particularly the PMI in recent years. Both agencies should be commended for their excellent work. However, Zanzibar remains too dependent on foreign aid to sustain its own health programs. The Government of Zanzibar has demonstrated a strong political commitment to controlling malaria on the islands of Zanzibar, going beyond political statements and messages. Now that malaria is under control, that commitment must turn to the islands’ dependency on foreign aid. Eliminating malaria from the islands of Zanzibar is feasible and possible, but keeping the island malaria-free will depend on local political and economic policies. The Government of Zanzibar should urgently implement reforms to foster economic growth. This will not only increase local tax revenues, ensuring that the Zanzibar government is more self-reliant in public health programs, but will also empower individuals and communities to do more to control and treat the disease.

1980 to 7.2 in 2005. Taiwan’s real GDP per capita increased from US\$18,000 in 2003 to an estimated US\$29,500 in 2007.

⁴⁵ Owen A, Stephen, W (2007) Is Trade Good for Your Health? *Review of International Economics*, 15(4), 660-682.

⁴⁶ World Bank “Doing Business 2008, Tanzania” 2007 World Bank Group, Washington DC, Available at: <http://www.doingbusiness.org/Documents/CountryProfiles/TZA.pdf>

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