

Malaria elimination in Sri Lanka: what it would take to reach the goal

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ABSTRACT

Fifty years after narrowly missing the opportunity to eliminate malaria from Sri Lanka in the 1960s, the country has now interrupted malaria transmission and sustained this interruption for more than 12 months – no indigenous malaria cases have been reported since October 2012. This was achieved through a period overlapping with a 30-year separatist war in areas that were endemic for malaria. The challenge now, of sustaining a malaria-free country and preventing the reintroduction of malaria to Sri Lanka, is examined here in the context of rapid postwar developments in the country. Increased travel to and from the country to expand development projects, businesses and a booming tourist industry, and the influx of labour and refugees from neighbouring malarious countries combine with the continued presence of malaria vectors in formerly endemic areas, to make the country both receptive and vulnerable to the reintroduction of malaria. The absence of indigenous malaria has led to a loss of awareness among the medical profession, resulting in delayed diagnosis of malaria despite the availability of an extensive malaria diagnosis service. Highly prevalent vector-borne diseases such as dengue are competing for health-service resources. Interventions that are necessary at this critical time include sustaining a state-of-the-art surveillance and response system for malaria, and advocacy to maintain awareness among the medical profession and at high levels of government, sustained funding for the Anti-Malaria Campaign and for implementation research and technical guidance on elimination. The malaria-elimination effort should be supported by rigorous analyses to demonstrate the clear economic and health benefits of eliminating malaria, which exceed the cost of a surveillance and response system. An annual World Health Organization review of the programme may also be required.

Key words: delay in diagnosis, elimination, imported malaria, malaria, prevention of reintroduction, receptivity, South-East Asia, Sri Lanka, vector-borne diseases, vulnerability

INTRODUCTION

Sri Lanka's protracted history of malaria is studded with some landmark events in global public health, such as the severe malaria epidemic of the 1930s, which led to an estimated 5.5 million cases and 80 000 reported deaths;^{1,2} and near elimination of malaria during the Global Malaria Eradication Programme of the 1960s,¹ which reduced the number of cases from 91 990 in 1953 to a mere 17 in 1963, with many of these being imported infections (see Figure 1). In the past decade, the national malaria control programme of Sri Lanka, the Anti-Malaria Campaign (AMC), has, once again, achieved a

steady reduction in malaria transmission rates in the country. These have been sustained for more than 10 years over a period that spanned a 30-year separatist war that raged in the north and east of the country – areas that were previously highly malarious.³ There have now been no indigenous malaria cases in the country among its 20 million inhabitants for over a year (see Figure 1).

This time, the opportunity to eliminate the disease from Sri Lanka presents itself against a background of postwar developments in the country that impose high risks for malaria resurgence; a global momentum to eliminate malaria; the

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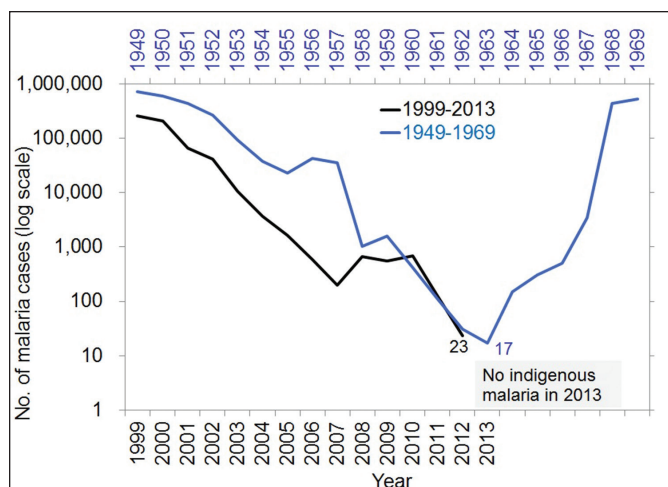


Figure 1: The reported annual incidence of malaria since 1999 presented with the annual malaria incidence in the period 1949–1969 to illustrate the near elimination in the earlier years and the resurgence that followed

odds of a persisting vulnerability and receptivity to malaria in the country; and enormous challenges of sustaining a focus on a disease that is no longer endemic. This paper critically examines the prospects of eliminating malaria from Sri Lanka, and the even greater challenge of preventing its reintroduction to the country.

Challenges for sustaining interrupted transmission and preventing reintroduction

While intense surveillance-based operations of case detection, management, entomological surveillance and vector control have contributed to interrupting local transmission in the country since October 2012, postwar developments continue at an accelerated pace. These have resulted in an influx of tourists; imported labour from malaria-endemic countries – particularly India and China; refugees from neighbouring endemic countries; Sri Lankan expatriates returning home; and nationals travelling for business or leisure, all of which are bringing a steadily increasing proportion of imported malaria cases into the country (see Figure 2). In 2013, nearly 60% of imported malaria was among travellers of Sri Lankan origin

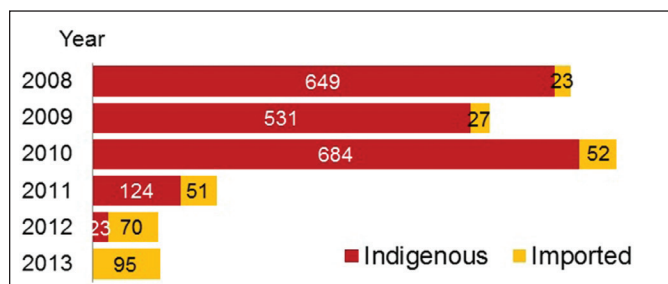


Figure 2: The number of microscopically confirmed malaria cases reported from Sri Lanka (indigenous and imported), 2008–2013

who had contracted malaria overseas, and the vast majority of the rest was of Pakistani and Indian origin (see Figure 3). Sri Lankan peacekeeping forces returning from service in malaria-endemic countries, irregular migrants, business travellers and boat people voyaging the Indian Ocean and making landings in Sri Lanka have been the main contributors to imported malaria being reported with increasing frequency in Sri Lanka over the past few years (see Table 1).

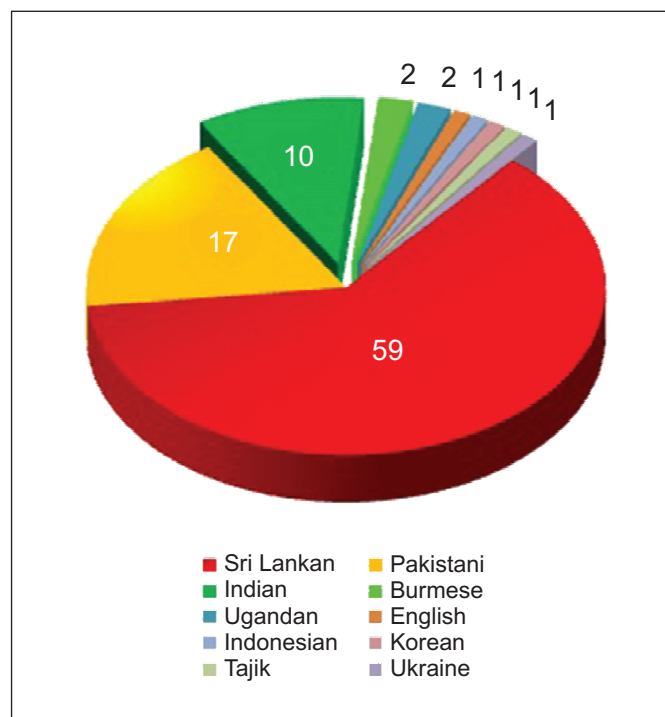


Figure 3: Number of patients with imported malaria in Sri Lanka in 2013, by nationality

Table 1: Occupational categories of imported malaria cases among foreign and national patients, Sri Lanka 2013

Occupation category	Sri Lankan nationals	Foreign nationals
Armed forces/police	4	
Business/trade	20	2
Seaman	13	2
Technician/skilled labourer	6	4
Manual labourer		3
Professional	6	
Student	4	
Tourist	3	5
Pilgrim	3	
Asylum seeker		19
Social worker		1
	59	36

Since the end of the separatist war, Sri Lanka has been on a steep development trajectory with the building of new air and sea ports, including in areas that were previously endemic for malaria; the construction of several highways traversing the country; increasing global business investments; and a rapidly growing tourist industry, all of which are associated with increased travel of foreign nationals; and introduction of foreign labour into the country, increasing the number of imported malaria cases. Ongoing construction projects are leading to the creation of new vector breeding sites, including in previously endemic areas.

Meanwhile, the principal vector of malaria, *Anopheles culicifacies*, and secondary vectors such as *A. subpictus*, are as prevalent in the country as previously (see Figure 4). Furthermore, *A. culicifacies* has reportedly diversified its breeding habitats from previously clear, unpolluted slow-flowing waters to more polluted and still sources of water.⁴ Although evidence is unavailable on current vectorial capacities of these mosquito species, their prevalence implies a continuing high receptivity to malaria in previously endemic areas. This, when combined with the increasing reports of imported malaria from diverse parts of the country, almost certainly points to a sustained high risk of malaria reintroduction unless rigorous measures are taken to prevent it.

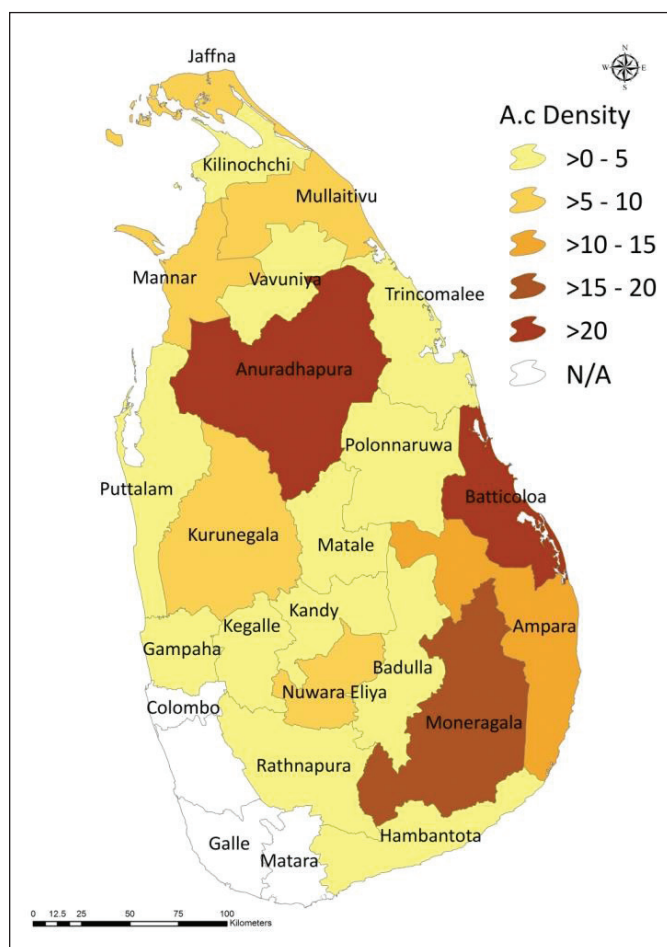


Figure 4: Geographical distribution of *A. culicifacies* (principal vector) during the high-density season in Sri Lanka, 2013

Compounding these risks are some inevitable challenges associated with sustaining health services and surveillance for a non-prevalent disease. Clinical awareness of malaria has plummeted to the extent that in 2012 there was an unacceptable delay in the diagnosis of patients with malaria (see Figure 5). In nearly half of indigenous cases, and 66% of imported malaria patients, five or more days elapsed from the time the patient sought treatment until a malaria diagnosis was made; in 10% and 20% of these patients respectively, it took more than 10 days for a malaria diagnosis to be made. An external evaluation of the malaria-elimination programme in 2013 found that, although diagnostic services for malaria are adequately and widely distributed in all parts of the country, rates of referral by medical practitioners for a malaria diagnosis remain persistently low.⁵ As a result, the disease had even progressed to severe and complicated malaria in some patients. Despite this, zero malaria mortality has been sustained in the country since 2007 owing to a high standard of clinical management of severe malaria patients.

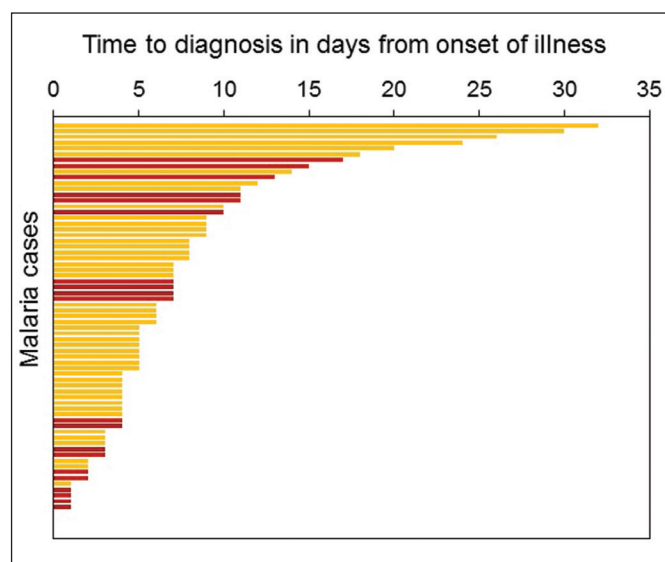


Figure 5: Number of days from onset of illness to blood testing for malaria among indigenous (yellow) and imported (red) malaria patients in Sri Lanka in 2012

Malaria control and elimination continues as a priority of the Ministry of Health, with the directorate of the national malaria control programme, the AMC, providing technical guidance to the elimination programme. In the currently decentralized health system, this programme is implemented by the provincial ministries of health, through Regional Malaria Officers. The malaria control programme in 2003, and the elimination programme from 2008 onwards has been supported additionally by three successive grants from the Global Fund to fight AIDS, Tuberculosis and Malaria, amounting to USD 2 077 223, 2 159 122 and 2 159 122 for the periods 2003 to 2008, 2005 to 2009 and 2009 to 2013, respectively. Other vector-borne diseases such as dengue are highly prevalent (see Figure 6) and currently feature as one of the greatest public health challenges, competing fiercely for the attention of public health services, including human resources, at a provincial level.

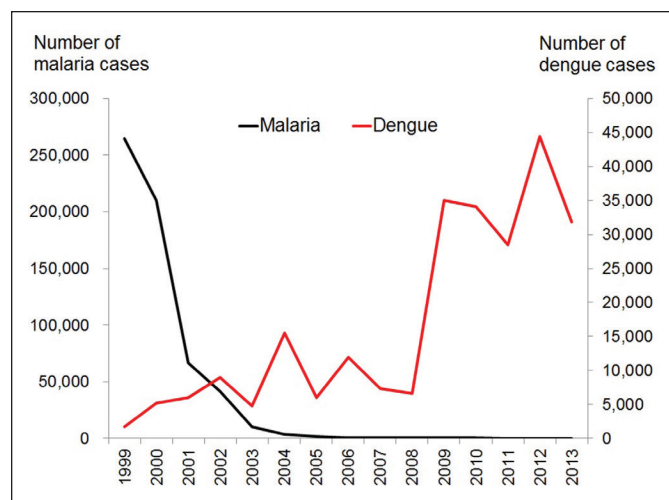


Figure 6: The reported annual number of malaria and dengue cases in Sri Lanka 1999–2013

What does success depend on?

Sri Lanka has achieved and sustained interrupted malaria transmission during the last stages of an intense separatist war that gripped the country and its health services and economy. Therefore, the goal of sustaining a malaria-free country after the cessation of the war appears well within the capacity of its health system, particularly with hindsight of a failed effort in the 1960s.

Surveillance with 24-hour compulsory notification and rapid response for malaria now needs to be the singular focus of Sri Lanka's elimination programme. Given the cost of malaria to the country over the years,⁶ the effort and resource investment required for a rigorous surveillance and response system would be entirely justified. Ports of entry to the country by both sea and air; building construction sites, such as those for the accelerated building of highways; free-trade zones; new sea ports and industrial parks; and other imported-labour-intensive activities will need to be the focus of enhanced surveillance for malaria. The necessary policy and strategy adjustments to act within the recently adopted *Sri Lanka National Migration Health Policy*⁷ will need to be developed to deal with the influx of labour and migration from neighbouring highly malarious countries. One example is to allow compulsory screening of migrant labour.

Sustaining awareness of malaria among public-health medical practitioners, through in-service training, and continued collaboration with medical educators and professional medical associations and colleges, should be a priority. A high-quality malaria diagnostic service needs to be meticulously maintained by the AMC, with a system of externally accredited microscopists.

A focus on malaria elimination at the highest levels of government is now needed, to seek the cooperation of sectors beyond health, which govern and regulate major development efforts in the country. Rigorous economic analysis to demonstrate the cost effectiveness of preventing malaria

reintroduction would help as an advocacy tool for the much-needed continuation of national and international investments for malaria elimination and prevention of reintroduction.

Reflection on the previous near-eradication effort of the 1960s dictates two critical interventions to achieve and sustain elimination of malaria. One is for the Ministry of Health to ward off complacency and to refrain from shifting resources from malaria to other high-burden vector-borne diseases such as dengue. Sri Lanka's recent experience with a failed leprosy elimination serves as a stark reminder that proposals on integration of malaria services with health services for any other disease must not be considered for at least the next 5 years. In 1996, Sri Lanka reached the leprosy-elimination target stipulated by the World Health Organization (WHO), of less than one case per 10 000 population, and, thereafter, supported by eloquent policy arguments and a seemingly sound structural basis for integration, district-level anti-leprosy services were integrated into the general health services in 2001/2002⁸ – a move that has resulted in a resurgence of leprosy. The AMC needs, rather, to be reprogrammed, vastly strengthening its entomological and infection and disease surveillance and response arm; improving the quality of diagnostic services; and shifting its geographical focus on the strict basis of receptivity and vulnerability in different parts of the country. The second is to sustain a focus on and investment in research and technical guidance for malaria elimination and prevention of reintroduction. Steps for this are already being taken at a national level – the Sri Lankan research funding agencies will earmark modest funds for research on malaria for the next several years. One of the many factors that are widely believed to have contributed to the decline of malaria in Sri Lanka during the past few decades is the deployment of evidence-based control operations by the AMC at all level of the health system, supported by mobile malaria units, on the basis of an extensive national research effort on malaria. Such a strong research and technical basis would well serve the elimination and prevention of resurgence of malaria now.

DISCUSSION

The cost of malaria to Sri Lanka has been enormous over centuries and would be more so now in the context of globalization, competitive economies and higher standards of living. Recent attempts to estimate the cost of malaria to Sri Lanka,^{6,9,10} suggest massive economic benefit would be gained by malaria elimination, even though the methodology used in these studies barely broached the economic opportunities lost to commerce, trade and tourism,¹¹ or the cost of malaria to human development,^{12,13} making the estimated cost of malaria to Sri Lanka a gross underestimate. Exactly 50 years after a missed opportunity to eliminate malaria, the country stands today at a pivotal point in its malaria history. The price of an outstanding surveillance and response system which is now essential, is not beyond the affordability of Sri Lanka's health system, which is known to deliver an equitable and effective health service. Singapore, with similar environmental risks for malaria as Sri Lanka, has sustained a malaria surveillance and response system to keep the country malaria free, despite large volumes of labour migration into the country and small

local outbreaks,¹⁴ which must reflect an assumption that the investments are well below the cost of a malaria resurgence.

Although the WHO Region of South-East Asia, to which Sri Lanka belongs, bears the second largest burden of malaria in the world, second only to Africa, several countries within the region have made significant achievements in either eliminating malaria (Maldives in 1984) or, more recently, significantly reducing their levels of endemicity (Bangladesh, Bhutan, Nepal, and Timor-Leste).¹⁵ India and Myanmar still harbour considerable case incidence rates of malaria, contributing the most by far to the region's disease burden. Eliminating malaria from Sri Lanka, and sustaining a malaria-free status, would be an important regional milestone, serve as a much-needed boost to the concerted global malaria-elimination efforts, and help validate the sustained high investments for the global fight against malaria. The corollary – the cost of failure to achieve and sustain malaria elimination in Sri Lanka – would be far greater than the mere return of malaria. It would place the country at risk of artemisinin-resistant malaria, which has now extended from its point of origin at the Thailand–Cambodia border, reported in 2009,¹⁶ as far west as Myanmar. It would also risk the country facing the globally growing problem of insecticide resistance in vector mosquitoes, and thus confront an escalating cost of malaria control, which would jeopardize its development efforts.

Poverty of resources if often cited as a legitimate reason for failure of disease-control efforts, alluding to multiple demands on restricted health budgets and competing health priorities as making such goals unachievable. Yet, having achieved and sustained more than a year of arrested malaria transmission in Sri Lanka, and bearing in mind that international support for malaria elimination is accessible and forthcoming, this may not be such a limiting factor at present. A failure to sustain malaria elimination at this stage is more likely to reflect poor judgement and planning on the part of health and national authorities rather than of lack of resources. Some of Sri Lanka's characteristics, such as its island nature and thus not being as prone to unregulated human migration as countries with contiguous land borders; its land extent and terrain are not unwieldy; it has a highly performing and equitable health system; and it has a high literacy rate, are all factors that would support the feasibility of achieving and sustaining malaria elimination, despite the country's intrinsically high receptivity and vulnerability to malaria. Given the achievements so far, it is imperative that national investment of resources and effort continue unabated, and that the international support required to sustain this achievement is forthcoming.

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