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Situation of Malaria and Expansion of Key Interventions for Malaria Elimination in Bago Region, Myanmar, 2007-2015

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Abstract

Analysis of malaria trends is important for planning of malaria elimination. Therefore, we reviewed the malaria monthly reports and key interventions for malaria elimination in Bago Region of Myanmar between 2007 and 2015. Secondary data analysis revealed the trends in malaria morbidity, mortality, malaria positive rate (MPR), malaria species, annual parasite incidence (API) and annual blood examination rate (ABER). Key interventions included distribution of insecticide-treated net (ITN), long lasting insecticidal net (LLIN) and case detection. Over the 8-year period, malaria morbidity and mortality rates markedly reduced from 8 to 0.3 per 1,000 population and 1.4 to 0.1 per 100,000 population respectively. During 2010-2015, API and MPR correspondingly reduced. Together with the concomitant increase in ABER and townships with API lower than one per 1,000 population, confirmed cases of *P. falciparum* malaria markedly decreased from 91.1% in 2007 to 55.4% in 2015. Meanwhile, the ITN/LLIN scaling-up activities resulted in an increase in population coverage from 23.5% in 2011 to 69.3% in 2015. Data from the public sector showed declining trends in malaria morbidity and mortality and low API, increasing the chance of malaria elimination. Still, there is a possibility of residual malaria that may trigger a resurgence, and thus, it is worthwhile to promote surveillance systems, especially in private sector health care establishments.

Keywords: malaria situation, annual blood examination rate, annual parasite incidence, Myanmar

Introduction

Globally, there was 18% decline in malaria cases from 262 million in 2000 to 214 million in 2015 and 48% decline in malaria deaths from 839,000 in 2000 to 438,000 in 2015. Several countries in South-East Asia are now moving towards malaria elimination.[1] In Myanmar, the incidence of reported malaria decreased by 82% from 622,373 in 2005 to 112,776 in 2015 and deaths from malaria decreased by 98% from 1,707 in 2005 to 37 in 2015.[2] Furthermore, there was an accelerated decrease of 40% in the number of malaria cases in the public sector from 2015 to 2016.[2-3] The proportions of *Plasmodium falciparum* (Pf), *P. vivax* (Pv) and mixed infections in 2015 were 65.4%, 31.8% and 2.8% respectively.[2] The main source of data capture is from the regular reporting system in the public health facilities. The main vectors reported from all states and regions of Myanmar are *Anopheles minimus* and *An. dirus*.[3] The national malaria control programme (NMCP) aims to achieve malaria elimination in 2030 in line with the elimination strategy in the Greater Mekong Subregion.[4]

There are total 28 townships with a population of 4.9 million in Bago Region, Myanmar. Due to relatively low malaria incidence report, the region has been targeted by NMCP for malaria elimination in 2020.[3] In Bago Region, there were two malaria implementing partners during 2007: Japan International Cooperation Agency (JICA) and United Nations International Children's Emergency Fund. In 2015, there were seven partnerships tackling malaria, including JICA, University of Research Co., American Refugee Committee, Population Service International, Burnet Institute Myanmar, Myanmar Medical

Association and Myanmar Health Assistant Association. In 2007, there were 859 health facilities, 1,071 basic health staff and no village health volunteers. However, in 2015, the workforce capacity increased to 1,450 health facilities, 2,529 basic health staff and 1,525 village health volunteers.[4]

Alongside capacity building of basic health staff and village health volunteers, key interventions implemented for malaria elimination include early case detection and effective treatment, distribution of insecticide-treated nets (ITN) and long lasting insecticidal nets (LLIN) to communities, active case finding, and screening point activities. Indoor residual spraying was highly selective and implemented only in a few townships. Bago Region is well known as a model for good collaboration of implementing partners and existing JICA-initiated pilot studies. Hence, it was selected purposively to explore the malaria situation and the expansion of key interventions for malaria elimination during 2007-2015. Furthermore, malaria trend analysis is important in the planning and tracking the progress of malaria elimination in endemic settings. Therefore, the objectives of this study were to assess the malaria situation in Bago Region during 2007-2015 in terms of morbidity and mortality and assess the effectiveness of expanding key interventions for malaria in relation to coverage and population targeting, implementation of case detection, and scaling-up of ITN and LLIN distribution.

Methods

We conducted a cross-sectional study of malaria cases in Bago Region of Myanmar (Figure 1) during 2007-2015 using the secondary data analysis method.

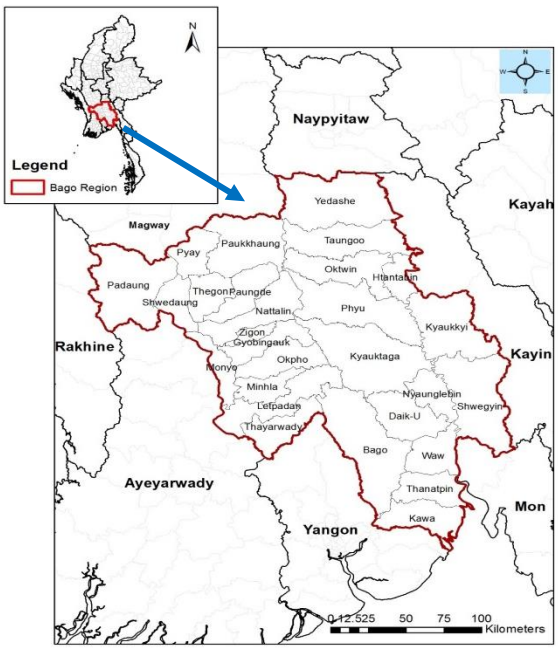

Figure 1. Map of Bago Region, Myanmar

Probable malaria cases were used during 2006-2010 since the monovalent rapid diagnosis test (RDT) used during that period could detect only Pf. Thus, RDT-negative patients with fever and travel history were presumed to have species other than Pf and were treated with chloroquine[2].

Confirmed malaria cases referred to cases confirmed either by microscopy or RDT, regardless of clinical signs and symptoms or travel history. In 2011, NMCP switched to using combination RDT which can differentiate Pf and Pv, and thus, used the term "confirmed malaria".

Annual blood examination rate (ABER) is the number of parasitological tests carried out per 100 mid-year population. Annual parasite incidence (API) is the number of confirmed malaria cases per 1,000 mid-year population at risk. Malaria positivity rate (MPR) is the percentage of positive tests among all tests taken and examined. Malaria morbidity rate is the number of confirmed and probable malaria cases during the reporting period divided by mid-year total population and multiplied by 1000. Malaria mortality rate is the number of malaria deaths during the reporting period divided by total mid-year population and multiplied by 100,000. Case fatality rate (CFR) is the number of malaria deaths divided by the number of malaria in-patients multiplied by 100.[5,6]

Population at risk refers to the population living in a geographical area where locally acquired malaria cases were reported in the past three years.[7]

Net coverage is the percentage of households owning at least one ITN or LLIN. Net utilization is the percentage of the population that slept in a treated mosquito net during the previous night prior to the survey.

Data Source and Data Analysis

Data were collected from township-wise monthly reports and regional annual reports. The number of in-patient malaria cases and deaths and out-patient malaria cases were extracted from township hospital reports and monthly carbonless registers of both basic health staff and village health volunteers.[8-9] Data were validated using EpiData Entry software (version 3.1, EpiData Association, Odense, Denmark).

The LLIN coverage was obtained from the periodic net surveys. The study was carried out in eight randomly selected townships in Bago Region and eight randomly selected villages from each township.

Data of monthly malaria reports from all 28 townships and Bago Region in 2007-2015 were analyzed for frequencies, proportions and rates.

Results

In Bago Region, the number of reported malaria cases was 37,170 (morbidity rate 8/1,000) in 2007 and 1,342 confirmed cases (morbidity rate 0.3/1,000) in 2015, resulting in reduction of morbidity rate by 96.3% over eight years. Malaria cases accounted for 4.3% (34,872/810,977) of all out-patients in 2007 and 0.1% (877/1,291,052) in 2015. The overall patient attendance for malaria treatment significantly increased by 53.0% for out-patients and 62.4% for in-patients during 2007-2015.

Regarding to malaria fatalities, there were 85 deaths (mortality rate 1.4/100,000) in 2007 and four deaths (mortality rate 0.1/100,000) in 2015. Thus, malaria mortality rates were reduced by 95.5% over eight years. The CFR reduced from 2.0% (85/4,298) in 2007 to 0.9% in 2015. However, there was a slight increase in CFR from 0.4% (8/1,940) in 2013 to 0.9% (4/465) in 2015. For admitted patients, malaria deaths accounted for 3.9% (4,298/110,205) of all patients in 2007 and 0.2% (465/207,622) in 2015. Total malaria deaths accounted for 5.9% of total deaths in hospital during 2007 and reduced to 0.2% during 2015 (Figure 2).

Concerning the case detection method, a programmatic shift was apparent in blood examination by microscopy to RDT being introduced in 2007. The number of RDT examinations increased from 46,228 in 2007 to 61,307 in 2012, then decreased to 40,729 in 2015. The number of RDT examinations increased by 25% between 2007 and 2015. However, during 2013-2015, there was a slight reduction in the number of malaria cases and RDT examination. For instance, RDT usage decreased by 27% during 2012-2013 and 9% in 2013-2015 (Figure 3).

ABER changed from 2.6% in 2007 to 7.1% in 2015, based on population at risk and API correspondingly reduced from 10.4 to 2.0 per 1,000 population (Figure 4). There were seven townships with an API lower than 1 per 1,000 population in 2010 and this increased to 14 townships in 2015. The malaria positivity rate was reduced by 92.1% during the same period, from 35.0% in 2007 to 2.8% in 2015.

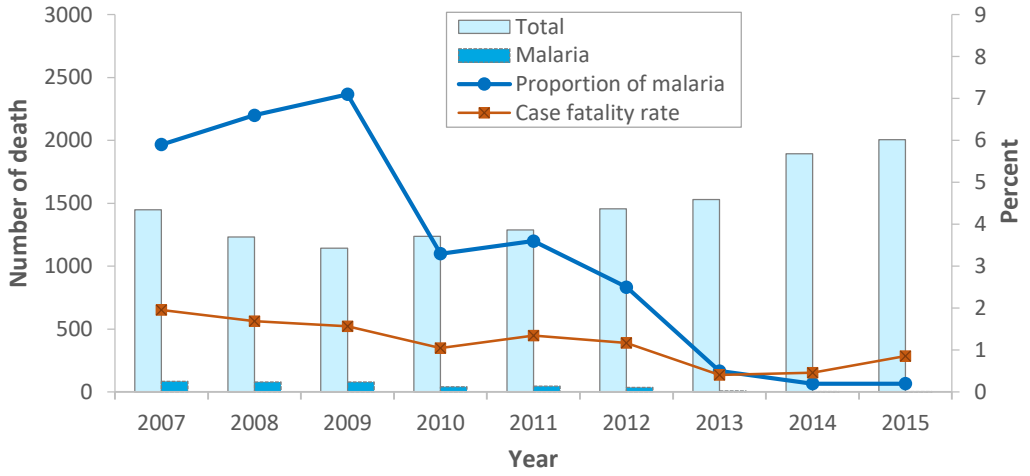

Figure 2. Malaria death among total deaths annually reported in Bago Region, Myanmar, 2007-2015

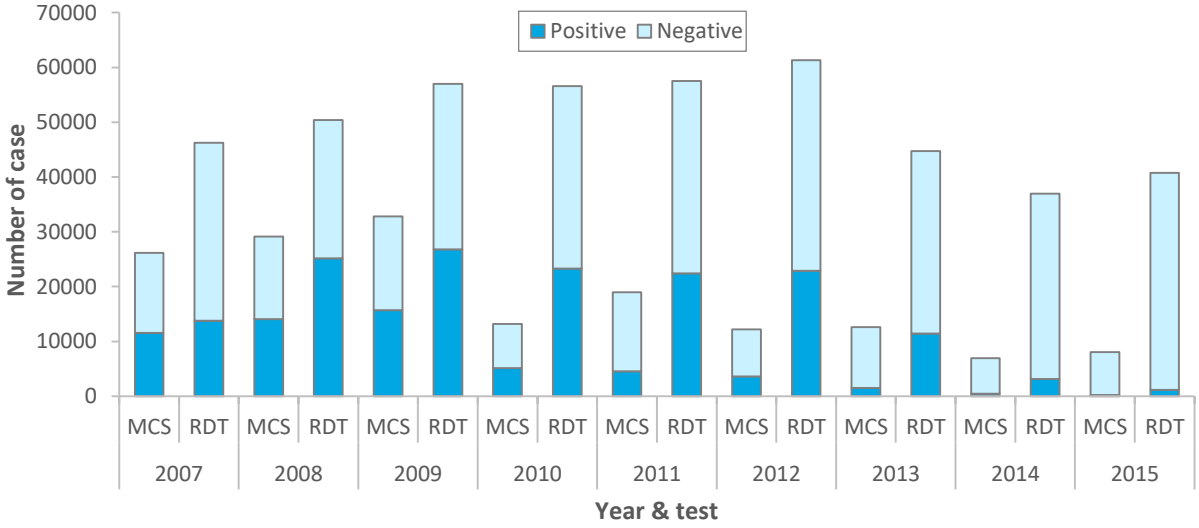

Figure 3. Results of blood examination by microscopy (MCS) and rapid diagnostic test (RDT) annually reported in Bago Region, Myanmar, 2007-2015

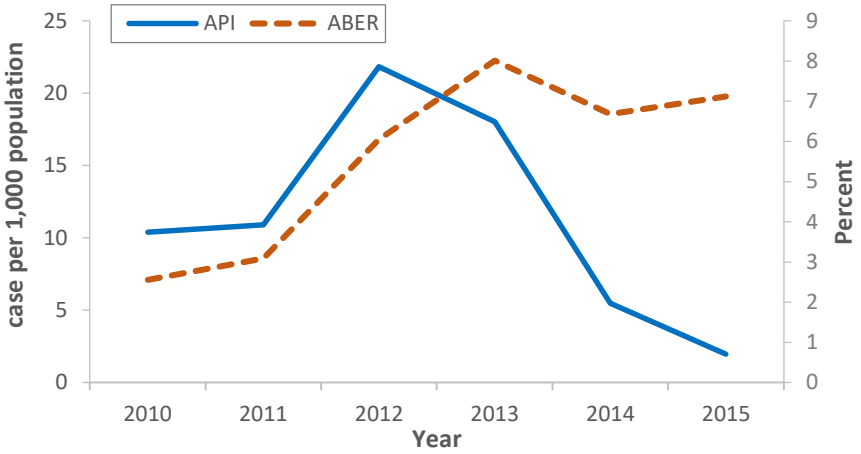

Figure 4. Annual parasite incidence (API) and annual blood examination rate (ABER) based on population at risk annually reported in Bago Region, Myanmar, 2010-2015

The proportion of Pf decreased from 91.1% in 2007 to 55.4% in 2015. Although the difference in proportion between Pf and Pv cases was wide (91.1% and 8.6%) in 2007, it was significantly narrow (55.4% and 40.2%) in 2015 (Figure 5).

At the same time, the number of LLINs distributed gradually increased and replaced ITNs. The coverage mosquito net distribution increased from 23.5% in the first year of the survey during 2011 to 69.3% in 2014 (Table 1).

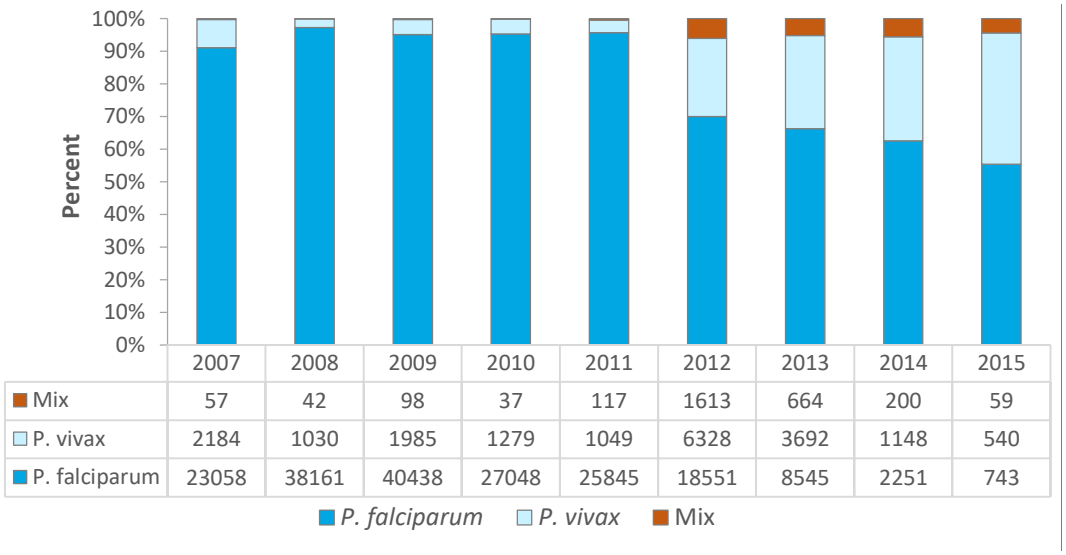

Figure 5. Distribution of malaria species annually reported in Bago Region, Myanmar, 2007-2015

Table 1. Number of insecticide-treated net (ITN) and long lasting insecticidal net (LLIN) distributed in Bago Region, Myanmar, 2007-2015[4]

Year	ITN		LLIN		Population Coverage of ITN/LLIN (Percent)
	Number of township	Number of ITN	Number of township	Number of LLIN	
2007	0	0	2	13,487	N/A
2008	4	5,413	0	0	N/A
2009	5	14,467	9	37,106	N/A
2010	4	21,500	4	43,880	N/A
2011	5	65,254	1	2,556	23.5
2012	18	238,829	8	119,310	73.2
2013	14	68,812	16	20,980	56.9
2014	0	0	0	16,044	69.3
2015	0	0	15	206,902	N/A

N/A = data not available

Discussion

Malaria morbidity and mortality rates reduced during 2007-2015 in light of expanding key program interventions in Bago Region. The CFR reduced during 2007-2013, yet slightly increased in 2014-2015 possibly due to reporting variability. This might also be due to lack of awareness in malaria and its complications leading to late arrival at the hospitals, reduction of herd immunity in the community, or competency gaps of hospital staff in managing severe malaria patients. As the number of people with malaria who visited health facilities decreased, basic health staff at the peripheral level had less awareness and reduced skills in malaria diagnosis and treatment. This might cause delayed treatment, severe complicated malaria and even death. This issue is important for malaria elimination and needed to be explored further.

However, as government health facilities are the main sources for detection of confirmed cases by standard procedures and malaria treatment according to the national treatment guidelines, the reduction in malaria proportion in these facilities might reflect a massive decline in malaria incidence.

The equal proportion of Pf and Pv cases might be due to the switch from monovalent to bivalent RDT from 2011 onwards and the change in operational definition[2] as recommended by NMCP[3]. However, the gradual reduction in proportion of Pf, especially during 2012-2015, matches well with the reduction in trends of malaria incidence due to Pf[5]. As Pf causes severe complicated malaria and deaths, reduction in proportion of Pf malaria cases is a good sign for Pf elimination. We compared this information with the data from Rakhine State where malaria transmission was more active and found that the proportion of Pf (82.1%) was much higher than that of Pv (14.2%)[10] in 2014. However, introducing ultra-sensitive RDTs in areas targeting malaria elimination could facilitate accurate detection and treatment[11-13].

The frequency of microscopic examination reduced since 2009 due to lower availability of microscopic facilities (laboratory technicians, microscopes, electricity at hospital level), and easily available and more user-friendly RDT test-kits as also noted by other studies from Asia and Africa[12-14]. The ability to perform microscopy depends on training, practice, skills maintenance, slide preparation techniques, workload, condition of microscope and quality of essential laboratory supplies. Reputed experts, even in developed countries, are scarce.[14-17] Revitalization of microscopy is essential as it is the gold standard for drug efficacy studies and for malaria elimination.[7]

Using population at risk as denominator, there was an increasing coverage of case detection (ABER). This clearly indicated better targeting of population at risk in low malaria endemic settings. This explained why the number of blood examinations increased among malaria-risk populations, yet decreased among the general population, indicating better program performance in case detection. The total malaria positivity rate in 2015 was 2.8% in Bago Region and 6.9% nationwide.[3] Improved active case detection methods, in addition to passive case detection methods, are indispensable, especially in hard-to-reach areas of artemisinin resistant containment as proven by one recent study from Myanmar in 2017[18].

Another study from Myanmar pointed out the necessity to strengthen health information and monitoring systems to avoid missing information[19]. Furthermore, a scaling-up of ITN and LLIN distribution in Bago Region during the study period indicated higher population coverage and utilization, not only ensuring a reduction in malaria transmission, but also usage of ITN and LLIN could thwart the spread of malaria resistant parasite strains noted by one recent study in Myanmar[20]. This would have an impact on malaria incidence reduction.

Limitations

All malaria cases analyzed were from public health facilities, exclusive of those from clinics run by implementing partners and private organizations. Data validity was relatively weak as the suspected and probable case definitions for malaria before and after 2011 differed.

Patient duplication might have occurred in program records as out-patients without any relief at health facilities from the periphery were referred to hospitals from the public sector and were registered as in-patients without any record link. However, malaria deaths might have been under-reported as the major source of death reports were from public hospitals, not private hospitals or communities.

Conclusion

The data from the public sector revealed declining trends of malaria morbidity, mortality and low API in Bago Region during 2007-2015, increasing the chance of malaria elimination in the near future. The decline might be linked to improved program efforts in terms of better targeting of populations at risk of malaria, an increase in the number of malaria testing and treatment according to program guidelines, and the expansion of ITN/LLIN programs to reduce malaria transmission.

Recommendations

As there was still a possibility of residual malaria that might stimulate resurgence, it was important to promote surveillance, especially in private health care establishments in Bago Region as well as in other endemic regions of Myanmar in order to gain a complete picture of the situation. The NMCP should advocate for a higher level of commitment to categorize malaria as a notifiable disease to increase reporting, case yield and better estimates, especially from private and non-health sectors. More in-depth studies on the epidemiology of malaria and the association of the two key interventions and their impact on malaria trends are needed for better planning and evaluation in order to reach the elimination target.

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Suggested Citation

Situation of malaria and expansion of key interventions for malaria elimination in Bago Region, Myanmar, 2007-2015. OSIR. 2018 Dec;11(4):7-13.

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