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Field Epidemiology Training Program, Bureau of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625901734-5, Fax: +6625918581, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Severe Complicated Malaria in High Risk Areas of Mon State, Myanmar, 2006-2012

Nyi Nyi Lwin[1,*], Kyaw TT[2], Hlaing T[2], Satimai W[3], Niramitsantipong A[3]

1 Yangon Regional Health Department, Ministry of Health, Myanmar
2 National Malaria Control Program, Nay Pyi Taw, Ministry of Health, Myanmar
3 Bureau of Vector Borne Disease Control, Department of Disease Control, Ministry of Public Health, Thailand

* Corresponding author, email address: mr.nyinyilwin007@gmail.com

Abstract

Cases of severe complicated malaria in Myanmar had declined during 2006-2012, yet some townships in the southeastern part continued to report poor outcome of malaria patients in spite of applying similar interventions as other high-risk areas. The purpose of this paper was to understand the reasons behind the poor malaria outcome of some townships in Mon State. We described trends and distribution of severe complicated malaria cases in 2006-2012. During 2006-2012, Yae Township contributed one-third to half of all severe complicated malaria cases in Mon State every year. In 2012, more than 25% of confirmed malaria cases were reported from high risk areas, including Beelin, Kyaikhto, Thaton and Yae Townships. Among these townships, Yae and Kyaikhto reported higher proportion of severe complicated malaria cases among under five children and pregnant women in 2012. In addition, fewer number of malaria cases was detected by village health volunteers than basic health staff in these townships, which might be due to inaccessibility to health services. Strengthening surveillance system and community-based malaria control program in Yae and Kyaikhto might reduce severe complicated malaria in these areas.

Keywords: severe complicated malaria, Mon State, micro-stratification, Myanmar

Introduction

Of 10 countries with ongoing malaria transmission in Southeast Asia, incidence of confirmed malaria cases decreased to 75% or more in five countries (Bangladesh, Bhutan, Democratic People's Republic of Korea, Nepal and Sri Lanka) between 2000 and 2012. It was projected that by 2015, incidence of malaria cases would decrease to more than 75% in Thailand and Timor-Leste, and 50-75% in India. However, incidence trends in Indonesia and Myanmar were obscured by changes in diagnostic or reporting practices.[1]

Among six Mekong countries, the malaria burden was the highest in Myanmar.[2,3] Malaria has been a major public health problem in Myanmar due to climatic and ecological changes, population migration, development of multidrug resistant *P. falciparum* parasites and insecticides resistant vectors, and changes in behavior of malaria vectors.[4] During 2012 in Myanmar, total number of confirmed malaria cases was 375,503 (annual parasite index 7.7 per 1,000 population) and number of total malaria deaths was 403 (0.8 per 100,000 population). Cases of severe complicated malaria were significantly decreased from 10,160 in 2008 to 4,160 in 2012.[5]

As credible evidences of artemisinin resistant malaria was reported in all townships in Mon State[6-8], immediate and multifaceted response was necessary in these areas. Interventions for malaria control in Mon State included vector control activities and utilization of community-based volunteers for malaria diagnosis and treatment in hard-to-reach areas in the state. Despite these interventions, some areas continued to report severe complicated malaria.[9] Furthermore, limited data were available to describe the occurrence and reasons for severe complicated malaria in the state.[10] The primary objective of this paper was to review malaria surveillance and describe trends and distribution of severe complicated malaria cases in 2006-2012 in Mon State. This study was conducted in order to understand the reasons behind the poor malaria outcome in some townships of Mon State despite similar interventions were implemented across the high-risk townships in the state.

Methods

Data Collection and Analysis

We conducted a descriptive study using different sources of surveillance data in all 10 townships of

Mon State during 2006-2012, including Mawlamyine, Kyaikhto, Beelin, Thaton, Kyaikmayaw, Mudon, Paung, Chaungzon, Thanbyuzayat and Yae Townships (Table 1).

Table 1. Data sources for malaria in Mon State, Myanmar, 2006-2012

Source	Data	Time period
Vector Borne Disease Control (VBDC), Mon State	Annual report for malaria	2006-2012
National Malaria Control Program (NMCP), Nay Pyi Taw*	Surveillance data	2006-2012
Mon State Health Department	State health profile and baseline data	2012
UNICEF and Global Fund	Microstratification maps and data	2011

**Data reported from the partner agencies were included.*

The annual report for malaria morbidity, mortality and geographic distribution data in 2006-2012 were obtained from Vector Borne Disease Control (VBDC), Mon State and National Malaria Control Program (NMCP), Nay Pyi Daw. Data from these two sources in 2012 were compared to extract volunteer activities in different townships.

In this report, a case of severe complicated malaria was defined as a person who was showing one or more of the following clinical criteria: altered or decreased consciousness; convulsion; persistent vomiting; inability to sit, stand or walk unaided; hyperpyrexia (39°C or more, with dry skin); severe anemia (hematocrit below 20% or hemoglobin level less than 6g/dl); and organ failure.[11]

Trends for severe complicated malaria cases and malaria deaths, and distribution by townships of severe complicated malaria cases were described. In addition, the distribution was also described by risk groups, townships and types of person who reported the cases (basic health staff - BHS or village health volunteer - VHV) to identify whether this might help explaining the differences.

Micro-stratification maps and data were collected by UNICEF and Global Fund during 2011 in Mon State to inform strategic use of resources in more focused and efficient ways. In this study, the micro-stratification maps of townships were merged into the state micro-stratification map using ArcGIS software.

Results

Mon State is a long narrow coastal state situated at the southeastern part of Myanmar (Figure 1). Mon State has a population of 2.1 million distributed in 10 townships. Most of the Mon people worked as rubber tappers, forest-goers and farmers.[12]

Figure 1. Map of Myanmar, showing Mon State

For both surveillance systems of VBDC and NMCP, the most basic reporting unit was the sub-center where a midwife was responsible for 5-10 villages, with support of VHV. The paper-based surveillance system was utilized to submit case registers and line-listing forms of malaria cases from the rural health center to township level. Township medical official, the focal administrative person in township, checked completeness and consistency of data manually for program management in township level. The township medical official then sent the data to the state level where the data were compiled, analyzed and submitted again to NMCP.[9]

The VBDC surveillance system covered all out-patients and in-patients with malaria from all townships in Mon State. Data in the VBDC surveillance system included a line-listing of individual patient's clinical and demographic information. Information with a limited number of malaria indicators, including number of malaria out-patient and in-patient, was also collected monthly through health management information system (HMIS), which was not considered sufficient to support VBDC with the information needed to manage the program.[13]

Micro-stratification was conducted by BHS in rural areas who are taught about the criteria and trained to

identify and map out the villages within high, moderate and low risk areas. Each village in every township was classified as malarious (Stratum 1), potentially malarious (Stratum 2) or non-malarious (Stratum 3). Stratum 1 villages were further categorized into high (1A), moderate (1B) and low (1C) risk areas. Main parameters for stratification were presence of indigenous cases, type of vectors found and ecological features favorable for malaria. Supporting parameters for stratification included distance from forest and the nearest health care facility.[14]

According to the micro-stratification data, four townships (Beelin, Kyaikhto, Thaton and Yae) were designated as high risk or Stratum 1A areas (Figure 2). Although only 10% of the population lived in these four townships during 2012 (Table 2), over one-quarter of the reported malaria confirmed cases were from those areas. Although Mawlamyine, the capital city of Mon State, was stratified as risk-free for malaria, 2.6% (458) of malaria confirmed cases were reported in 2012.

From 2006 to 2012, trends of both severe complicated malaria cases and malaria deaths decreased in Mon State (Figure 3). Many severe and complicated malaria cases were admitted and many malaria deaths were reported in Yae and Kyaikhto compared with other high risk townships. Each year, cases of severe complicated malaria from Yae Township contributed one-third to one-half of the reported cases.

In 2012, Yae, Kyaikhto and Mawlamyine Townships reported higher proportion of severe complicated malaria cases among all ages (Figure 4). Although high number of confirmed malaria cases among under five children was reported in Thaton Township, there was no severe complicated malaria in this high risk population during 2012. Pregnant women with malaria were mostly from Yae Township followed by Thaton, Thanbyuzayat and Beelin. However, among these pregnant women, higher proportion of complications was observed in Kyaikhto (100%), Beelin (20%) and Yae (11%) (Table 3).

Majority of confirmed malaria cases in 2012 were out-patients (93%). Community-based malaria case detection by VHV contributed 45% of all cases detected. Out-patient malaria cases detected by VHV were the highest in Beelin and Thaton while the detection by VHV was much lower than diagnosed by BHS in Kyaikhto and Yae, implying that activities of VHV were likely to be weaker in Kyaikhto and Yae Townships (Figure 5).

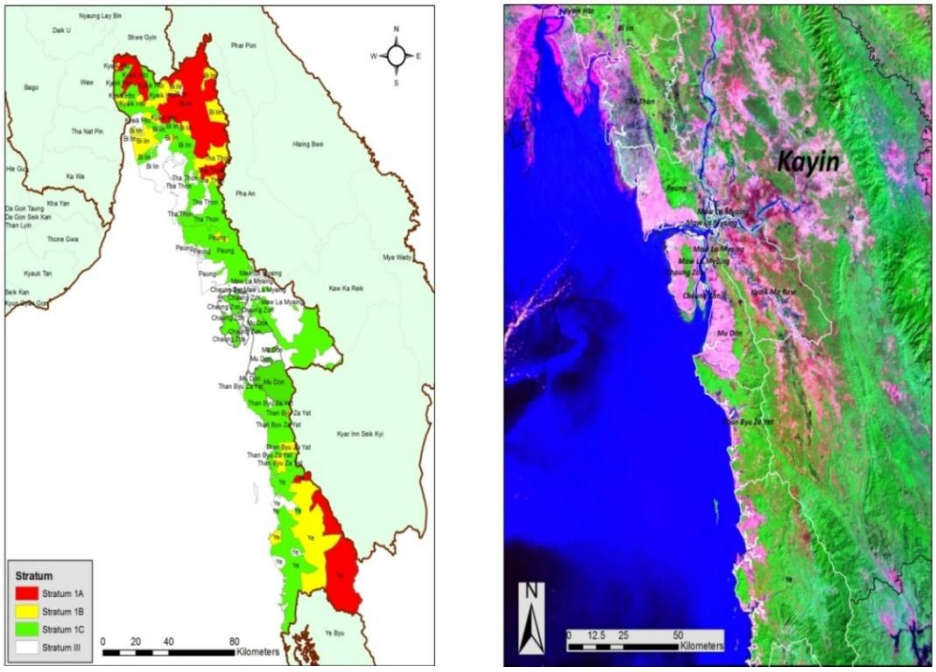

Figure 2. Maps on micro-stratification and vegetation of Mon state, Myanmar, 2011

Table 2. Number of villages and population in high and moderate risk areas of Mon State, Myanmar, 2012

Risk	Variable	Township			
		Beelin	Kyaikhto	Thaton	Yae
High	Village	85	26	11	15
	Population	37,710	13,617	5,117	6,244
Moderate	Village	48	30	44	63
	Population	39,545	23,082	26,608	58,020

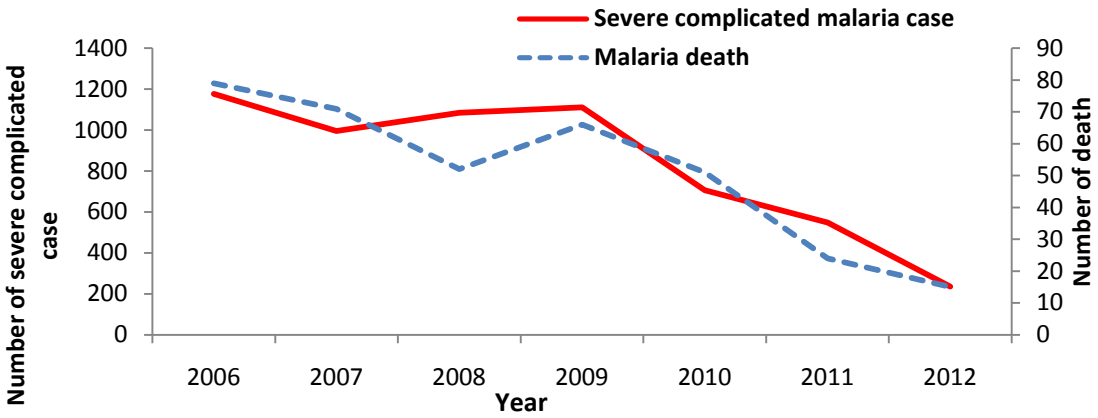

Figure 3. Trends of severe complicated malaria cases and malaria deaths in Mon State, Myanmar, 2006-2012

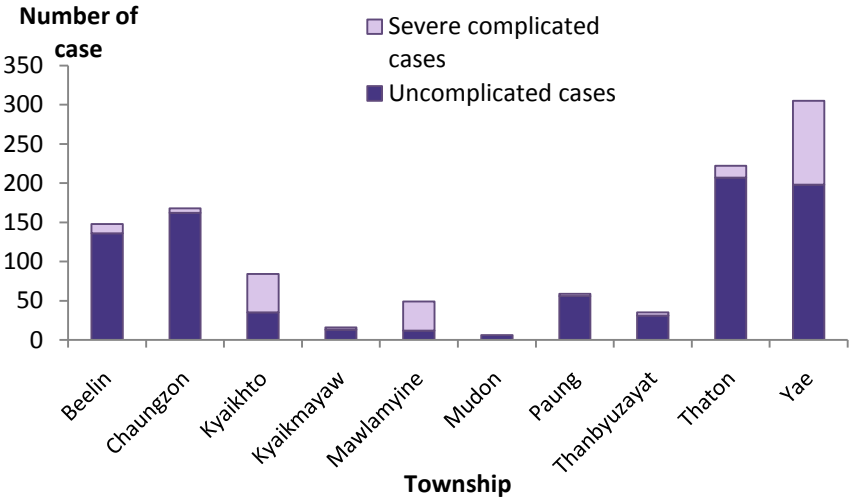

Figure 4. Township-wise distribution of uncomplicated and severe complicated malaria cases in Mon State, Myanmar, 2012

Discussion

Micro-stratification is useful to allocate available limited resources effectively and strategically according to levels of micro-stratification. The risk map will be an important planning tool in township as well as state, regional and central levels. Based on the risk map, a micro-plan is prepared at township level which includes a supply/logistics plan of diagnostic, treatment and preventative equipment, a training plan for BHS and VHV prioritizing the high risk areas, and a targeted program communication

Table 3. Number of total in-patient malaria cases and severe complicated malaria cases by different groups in Mon State, Myanmar, 2012

Township	In-patient			< 5 years			Pregnancy		
	Number of malaria	Number of severe complicated malaria	Percent	Number of malaria	Number of severe complicated malaria	Percent	Number of malaria	Number of severe complicated malaria	Percent
Beelin	148	12	8.1	73	1	1.4	5	1	20
Chaungzon	168	6	3.6	21	0	0	1	0	0
Kyaikhto	84	49	58.3	74	8	10.8	1	1	100
Kyaikmayaw	16	3	18.8	40	0	0	2	0	0
Mawlamyine	49	37	75.5	132	0	0	1	0	0
Mudon	6	0	0	9	0	0	1	0	0
Paung	59	3	5.1	58	0	0	0	0	0
Thanbyuzayat	35	4	11.4	64	0	0	6	0	0
Thaton	222	15	6.8	110	0	0	8	0	0
Yae	305	107	35.1	159	24	15.1	18	2	11.1

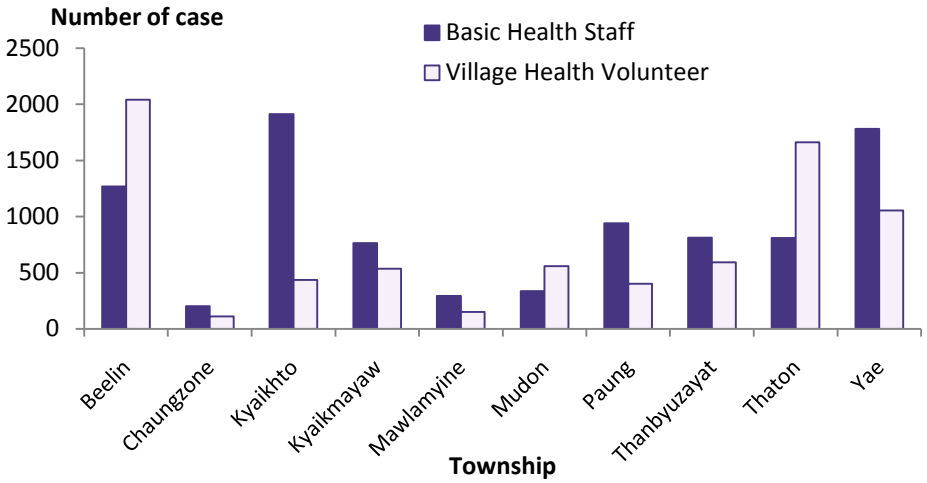

Figure 5. Number of out-patient malaria cases detected by basic health staff and village health volunteers by townships in Mon State, Myanmar, 2012

plan. Insecticide-treated bed nets provision and insecticide impregnation activities can be also strategically planned, based on the risk map. However, our finding of consistent high number of severe complicated malaria cases among high risk groups in Yae, Kyaikhto and Mawlamyine Townships during 2012 when compared with other townships with high malaria transmission suggested that micro-stratification method might not be sufficient to allocate resources in Mon State.

The routine malaria surveillance system which reported data on malaria deaths and severe complicated malaria cases from in-patient health facilities showed unambiguity about the figures of severe complicated malaria. Limited accessibility to public health care facilities in areas of political instability in Yae Township was likely to render delay in seeking medical care since a major cause for developing severe complicated malaria was due to missed or delayed diagnosis.[15-17]

The high number of reported severe complicated malaria cases and malaria deaths in Yae and Kyaikhto was likely due to delayed diagnosis and referral. Hence, the community-based malaria control program in these townships should be strengthened to reduce severe complicated malaria.

However, very few severe and complicated malaria cases were identified in Thaton Township, with no severe and complicated malaria among pregnant women and under five children, although there were many cases of confirmed malaria. It might be related with higher case detection by VHV in Thaton Township, and thus, could prevent occurrence of severe and complicated malaria and deaths.

Despite higher number of confirmed malaria cases reported from Beelin and Thaton Townships, earlier case detection and treatment among persons living in remote areas helped prevent severe malaria.[17] The lower case detection by VHV in Yae and Kyaikhto might be due to a problem in systematic recruitment of VHV in remote areas of these townships, leading to some villages without any VHV. Furthermore, some VHV did not work well due to lack of motivation and supportive supervision by BHS while BHS were overburdened with heavy workload of numerous activities across different health programs.[18] Another explanation might be due to less effective surveillance system for reporting of malaria cases in Yae and Kyaikhto Townships. Therefore, further studies were suggested to explore the causes of different case detection of malaria cases by VHV among these townships.

Although the capital city, Mawlamyine, was being micro-stratified as a no-risk area, our data showed high number of severe complicated malaria in the hospital, which might be the referral cases from other townships. Drawbacks of the malaria surveillance system in Myanmar were that patients' current residence reported by BHS might be the location of treatment taken, not their permanent residence[13], and unavailability of data from the private sector might lead to underestimation or misinterpretation of the data.

Limitations

This study was subjected to several limitations. Firstly, as the routine malaria surveillance data in Myanmar did not include patients' occupational status (for example, migrant workers) and actual residency status, we could not accurately describe the role of migrant workers in malaria epidemiology of Myanmar.

The official population in Mon State was stated as three million in 2008 and 1.9 million in 2009. Due to unreliable information on number of population, we reported number of cases as trend, instead of rate. This might mask some trends due to denominator population change.

Furthermore, our analysis was limited to only severe complicated cases. Despite that, analysis of trend in this study included a long time period (2006-2012) during which the malaria case detection was more specific, with rolling rapid diagnostic tests out. Lastly, 2012 data were passively reported and thus, our results might be subjected to reporting bias, which would be beneficial from validation of reporting checks.

Public Health Actions and Recommendations

Risk mapping of the townships should be updated again in 2014, thereby township-wise and health center-wise micro-planning for malaria control activities could be done according to the updated micro-stratification areas. Micro-planning means bottom-up planning on malaria control activities, starting from village level through sub-center, Rural Health Center to township level according to their needs. With the updated micro-stratification, health managers could identify the prioritized areas for resources allocation and vector control activities.

In addition, strengthening of community-based malaria services in Yae and Kyaikhto Townships was needed by means of providing incentives and supportive supervision to VHV by BHS for early detection of more cases in rural areas and preventing severe complicated malaria. Drug adherence according to the national guidelines by BHS and VHV in the rural areas should be explored for prevention of drug resistant malaria and severe complicated malaria. Even in low malaria burden areas such as Mudon and Chaungzon Townships, surveillance systems should be strengthened as well in order to prevent spread of drug resistant malaria since all areas in Mon State were regarded as Tier 1 areas.[19] Moreover, the routine surveillance data should include occupation status of the patients. Information on patients' permanent residence, instead of location of treatment provided, would be advantageous to more effectively plan malaria control activities.

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