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Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Epidemiological Trends of Malaria in Eastern Shan State, Myanmar 2000-2016

Ba Soe Thet[1,2*], Witaya Swaddiwudhipong[3], Krongthong Thimasarn[4], Aung Thi[5], Than Naing Soe[6], Zaw Lin[7]

1 International Field Epidemiology Training Programme, Epidemiology Division, Ministry of Public Health, Thailand2 Vector Borne Disease Control Unit, Eastern Shan State, Myanmar

3 Mae Sot General Hospital, Tak Province, Ministry of Public Health, Thailand

4 Department of Disease Control, Ministry of Public Health, Thailand

5 Department of Public Health, Ministry of Health and Sports, Myanmar

6 Department of Public Health, Ministry of Health and Sports, Myanmar

7 Eastern Shan State Public Health Department, Ministry of Health and Sports, Myanmar

*Corresponding author, email address: dr.basoethet@gmail.com

Abstract

Malaria is a priority communicable disease in Eastern Shan State (ESS) of Myanmar. This study aimed to describe the malaria situation, epidemiology and treatment services in ESS during 2000-2016. Data from township malaria monthly reports in ESS during 2000-2016 were analyzed by time, place, person, species and treatment services. Malaria morbidity, mortality and case-fatality rate decreased from 25.0 to 3.7 per 1,000 population, 15.0 to 0.2 per 100,000 population and 4.6% to 1.3%, respectively, during 2000-2016. The male to female ratio was 3:2 and those over 15 years old constituted 60% of all cases. The number of cases declined by 88% and 99% among those younger than 5 years of age and pregnant women, respectively. During 2011-2016, the case detection rate increased from 2% to 12%, and 94% of blood examinations used a rapid diagnostic test. *Plasmodium vivax* (63%) was the most prevalent parasite species, followed by *Plasmodium falciparum* (33%) while mixed parasites accounted for 4% of all infections. Non-government-controlled areas contributed more than 80% of cases between 2013 and 2016. Remarkable reductions in malaria morbidity and mortality in ESS followed improvements in early detection, appropriate treatment and effective vector control. However, the overwhelming contribution on caseload in non-government-controlled areas remain a challenge for the elimination of malaria in Myanmar.

Keywords: malaria, morbidity, mortality, annual blood examination rate, Eastern Shan State, Myanmar

Introduction

In 2015, there were an estimated 212 million cases of malaria and 429,000 malaria-related deaths globally. In the South-East Asia Region, about 1.4 billion people were at risk of malaria, with 237 million at high risk in 2015.[1] Malaria in Myanmar contributed approximately two-thirds of both morbidity and mortality in the Greater Mekong Subregion during 2013.[1] As a result, the National Malaria Control Programme (NMCP) was developed in coordination with both international and local agencies, including the World Health Organization to reduce the incidence of malaria to less than one case per 1,000 population in all states/regions by 2020 by scaling up malaria control interventions.[2]

Eastern Shan State (ESS) is situated in the most eastern part of Myanmar and consists of ten townships, eight sub-townships, 71 wards, 147 village tracts and 2,063 villages with a population of approximately 800,000. According to area micro-stratification of ESS in 2015, about 53% and 28% of the population lived in malaria risk areas and probable risk areas, respectively. Because of the high proportion of the population at risk of infection,

community-based malaria control interventions were developed and have been implemented since 2007 in ESS to increase accessibility of quality diagnosis and effective treatment, especially in remote areas.[3] For example, microscopy has been used for malaria diagnosis in health centers where microscopes are available and malaria rapid diagnostic tests (RDTs) have been used in all healthcare settings ranging from health centers to the community level. The basic reporting units are village health volunteers (VHVs) and basic health staffs. All examined cases are recorded in carbonless case registers and reported monthly.[4]

Eastern Shan State has experienced many malaria epidemics. One major epidemic occurred during 2001 in which an estimated 10,000 persons were affected with 1,066 reported deaths in 23 villages.[3] In addition, because ESS contains many so called "special regions" (politically unstable areas), non-government controlled areas, and extremely hard-to-reach areas, it is classified as a high risk malaria area.[3,5] Consequently, the extent of malaria and treatment service coverage is largely unknown. The objective of this study was to describe the malaria epidemiology and coverage of treatment services in ESS during 2000-2016 in the presence of malaria intervention activities.

Methods

We conducted a descriptive study on malaria in ESS during 2000-2016.

Data Sources and Data Collection

We reviewed aggregated data on malaria cases and deaths during 2000 – 2016 from the Vector Borne Disease Control (VBDC) programme at the state level. The data included monthly reports, carbonless registers from townships, State VBDC annual reports and reports from international non-governmental organizations (INGOs) and non-governmental organizations (NGOs). However, malaria data of time, place, person and type of species were not available before 2011. Data on case detection and management by type of service are available only after 2012.

Operational Definition

A confirmed malaria case was defined as a patient whose blood film was positive by microscopy or rapid diagnostic test (RDT). There were two types of reported malaria cases: outpatients (OP): those who had uncomplicated malaria, and inpatients (IP): those who had severe malaria, were hospitalized and had a high risk of death.[4]

The OP malaria case definition varied from year to year depending on the type of blood test performed. In the past, the NMCP diagnosed patients with positive blood films as “confirmed malaria cases” and “clinically suspected cases” based on clinical symptoms. In 2006, the NMCP introduced, to some health centers, RDT which could detect only *P. falciparum* species. Since 2011, the NMCP has been distributing (through the State VBDC) bivalent RDTs, which can diagnose *P. falciparum* and *P. vivax* malaria and, therefore, all malaria cases were regarded as confirmed cases.[4]

Data Analysis

We analyzed data between 2000 and 2016 for morbidity and mortality rates, OP and IP malaria cases and deaths by time and township. We also described the distribution of cases by type of service (i.e. health facility, village health volunteer and NGO/INGO), gender age and species from 2011-2016 because data prior to this period were not available. We calculated the annual blood examination rate (ABER) and annual parasite incidence (API) and used ArcGis 10.1 software for mapping.

Descriptive statistics including frequency, rates and proportions were computed. We calculated malaria morbidity rates per 1,000 and malaria mortality rates per 100,000. We calculated ABER from the number of patients examined by microscopy or RDT per 100 population and API rate per 1,000 population at-risk.[6]

Results

Malaria Morbidity and Mortality Rates, 2000-2016

Figure 1 shows the trends of malaria morbidity (per 1,000 population) and mortality rates (per 100,000 population) in Eastern Shan State between 2000 and 2016. The morbidity and mortality rates gradually declined between 2000 and 2009 and then remained fairly steady over the next 7 years. In 2000, the malaria morbidity rate was 25 per 1,000 and the mortality rate was 15 per 100,000 population. In 2016, the malaria morbidity rate was 3.7 per 1,000 and the mortality rate was 0.2 per 100,000. The highest morbidity rate (29.4/1,000) and mortality rate (19.4/100,000) were reported in 2001.

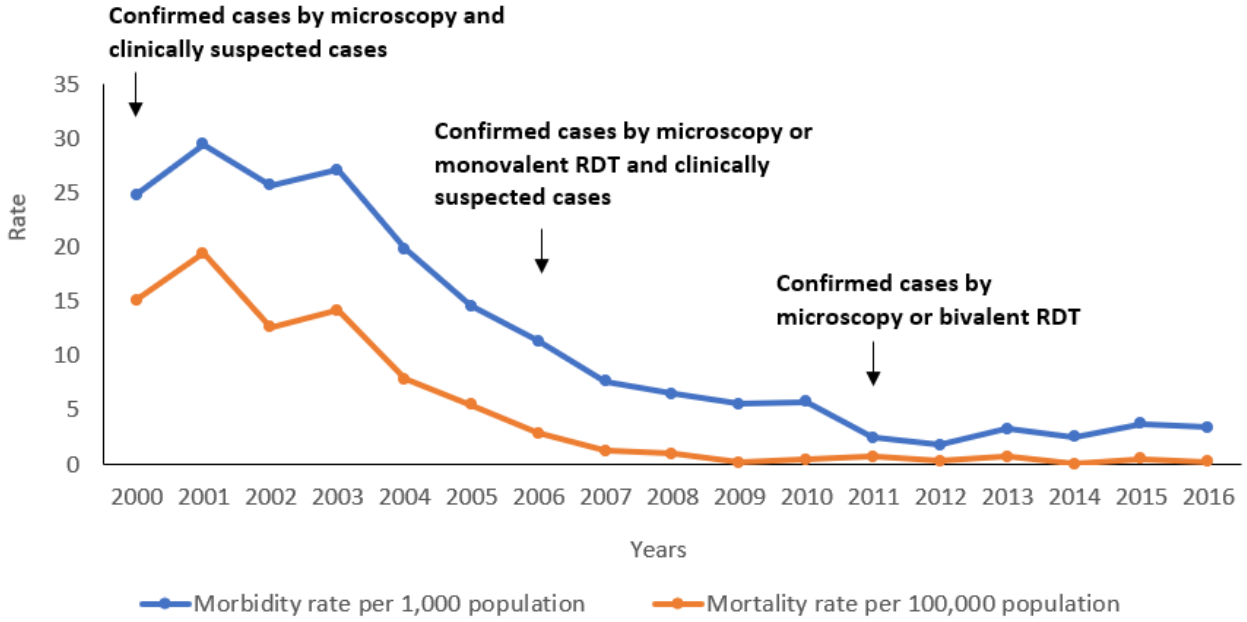

Figure 1. Trends of malaria morbidity rate (per 1,000 population) and mortality rate (per 100,000 population) in Eastern Shan State, Myanmar, 2000-2016.

Note: RDT: rapid diagnostic test.

Proportion of Malaria among All Hospital Cases and Deaths, 2000-2016

In 2000, there were 11,810 reported outpatient (OP) and 1,801 inpatient (IP) malaria cases. Only 83 malaria deaths were reported. The highest peak of OP and IP cases occurred in 2003 (16,102 and 2,144 cases, respectively). Between 2000 and 2016, there was a 75% reduction in OP malaria cases, a 92% reduction in IP cases and a 98% reduction in malaria deaths. The proportion of malaria cases among total patients decreased among both OP and IP cases. In 2000, there were 80,567 out-patients, of whom 11,801 (14.6%) were malaria cases while of the 253,443 out-patients in 2016, only 2,917 (1.2%) were malaria cases. A decrease in the proportion of IP malaria cases was similarly observed. In 2000, there were 330 deaths from all causes in hospitals of which 83 (25.2%) were from malaria. In 2016, of 126 deaths in hospitals, only 2 (1.6%) were malaria-related. The overall malaria case fatality rate (CFR) reduced during 2000-2016.

Malaria Morbidity and Mortality Rates by Township

Figure 2 shows the malaria morbidity (2a) and mortality (2b) rates in Eastern Shan State according to township in 2000, 2005, 2010, and 2016. The morbidity and mortality rates declined in all townships during 2000-2016. In 2000, Mong Tong Township had the highest malaria morbidity and mortality rates (56.4/1,000 and 52.8/100,000, respectively) while Mong Yaung township had the lowest morbidity rate (12.4/1,000). In 2016, there was a 78% reduction in morbidity rate and a 96% reduction in mortality rate in Mong Tong Township compared to 2000. The lowest morbidity rate in 2016 among all townships was in Mong Lar (0.1/1,000).

Coverage of Case Detection and Annual Blood Examination Rate by Township

Figure 3 shows the annual blood examination rates (ABER) in Eastern Shan State according to township in 2000, 2005, 2010 and 2016. In 2000, all the townships reported an ABER of less than 5.0% except for Mong Hsat Township which had an ABER of 10.6%. Case detection rates increased over the years from 2000 to 2016. In 2016, all townships reported an ABER of more than 5.0% and Mong Yang township had the highest rate of 29.4%.

Distribution of Malaria Cases by Month

Malaria cases occurred throughout the year but were highest during the rainy season (June to August). However, in 2015 and 2016, there were two peaks: one in the rainy season and the other in the early winter months. Each year, the majority of reported cases were male (60%).

From 2011 to 2016, malaria was reported among all age groups, but those aged 15 years and above constituted 60% of all cases. Figure 4 shows the trends in malaria incidence among children aged less than 5 years and pregnant women in Eastern Shan State during 2000-2016. The incidence of malaria

among children aged under 5-years and pregnant women decreased from 2000 to 2016. There were 2,385 malaria cases among children aged less than 5 years in 2000 and this number decreased to 385 in 2016. Although the incidence of malaria in children aged under 5 years declined by approximately 88.4% over this period, the proportion of malaria cases in this age group to all cases remained at 11%. For pregnant women, there were 663 malaria cases in 2000 and only 6 cases in 2016 (99.5% reduction).

Malaria Diagnosis and Species Distribution

A total of 251,931 cases were examined during 2011 to 2016 by both microscopy and RDT to identify confirmed malaria cases. Among all cases examined, most (94%) were detected by RDT and only 6% were diagnosed by microscopy. *Plasmodium vivax*, *Plasmodium falciparum* and mixed infections accounted for 63%, 33% and 4% of confirmed cases.

Malaria Case Management

Malaria case management was done not only in public health facilities but also in communities by village health volunteers (VHVs) trained by the NMCP. In addition, both national and international NGOs also conducted case management through mobile and fixed clinics. Data from VHVs and NGOs were not available during 2012 to 2014; although those services did implement malaria case detection services. In 2015, 70.7% of cases were treated at a public health facility, while 19.6% were treated by VHVs and 9.8% by NGOs. The proportion of cases treated by VHVs and NGOs implementing partners were22.9% and 12.4%, respectively, in 2016.

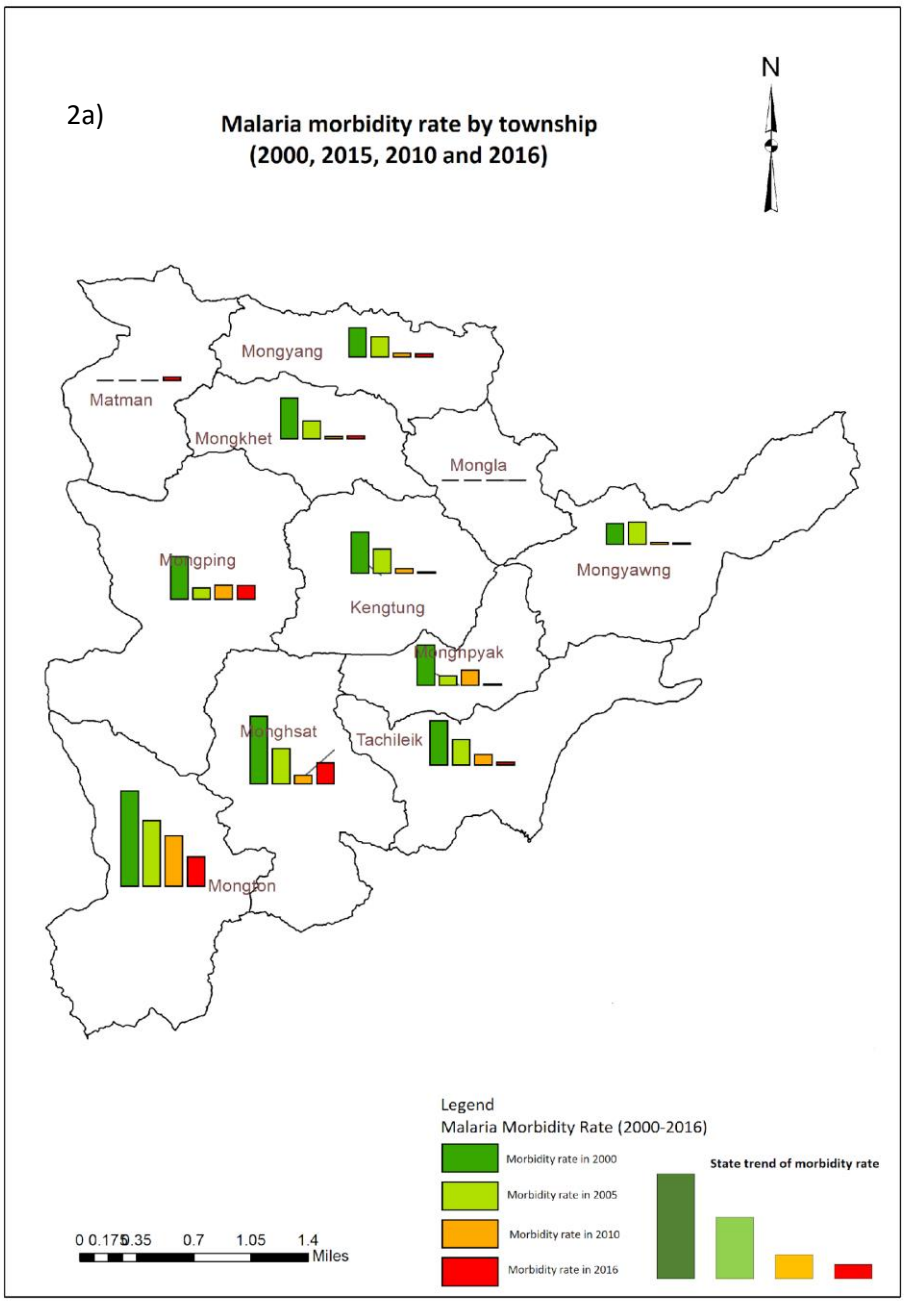

Figure 2. Malaria morbidity and mortality rates in Eastern Shan State, Myanmar according to township, 2000, 2005, 2010, and 2016 (1)

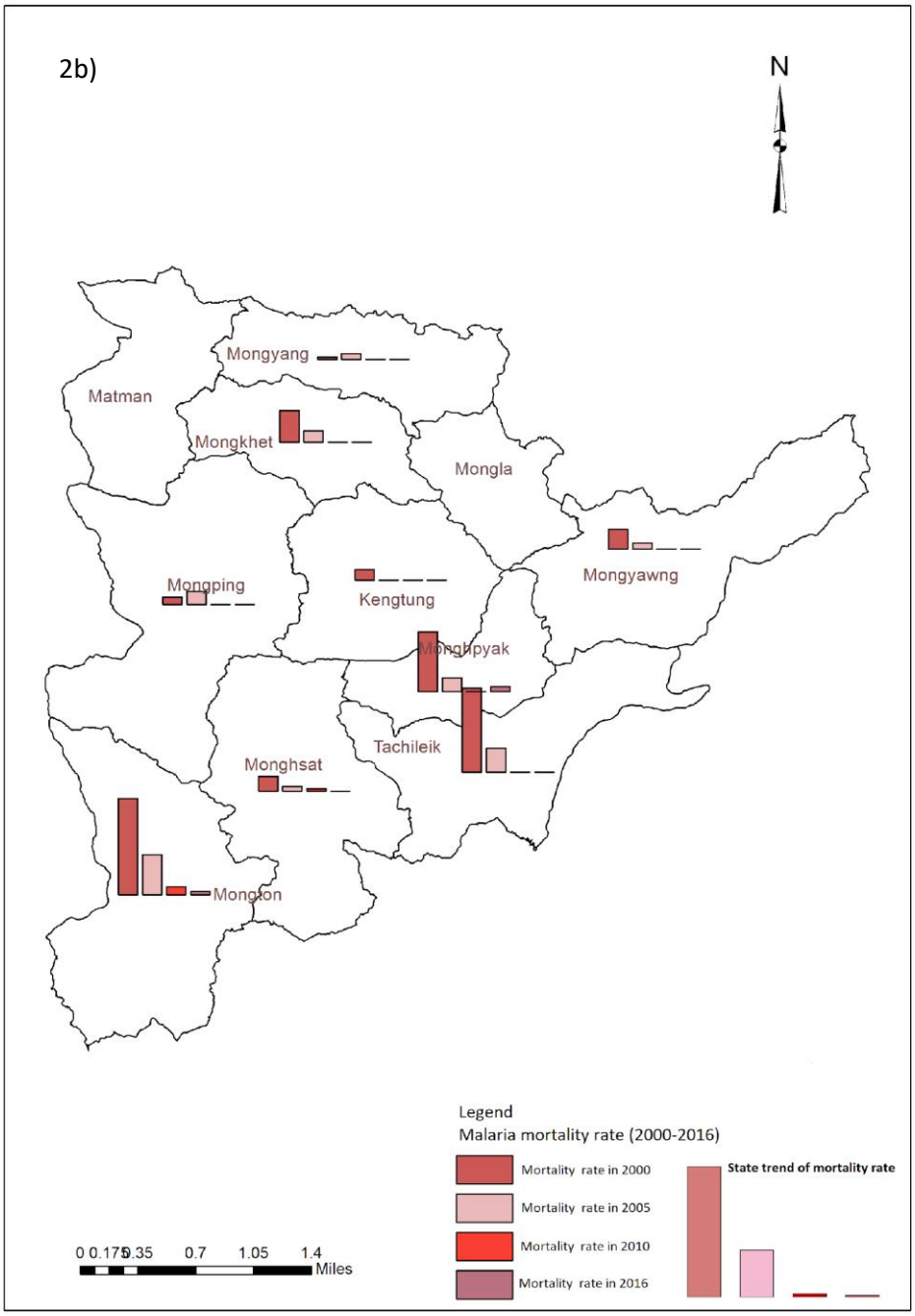

Figure 2. Malaria morbidity and mortality rates in Eastern Shan State, Myanmar according to township, 2000, 2005, 2010, and 2016 (2)

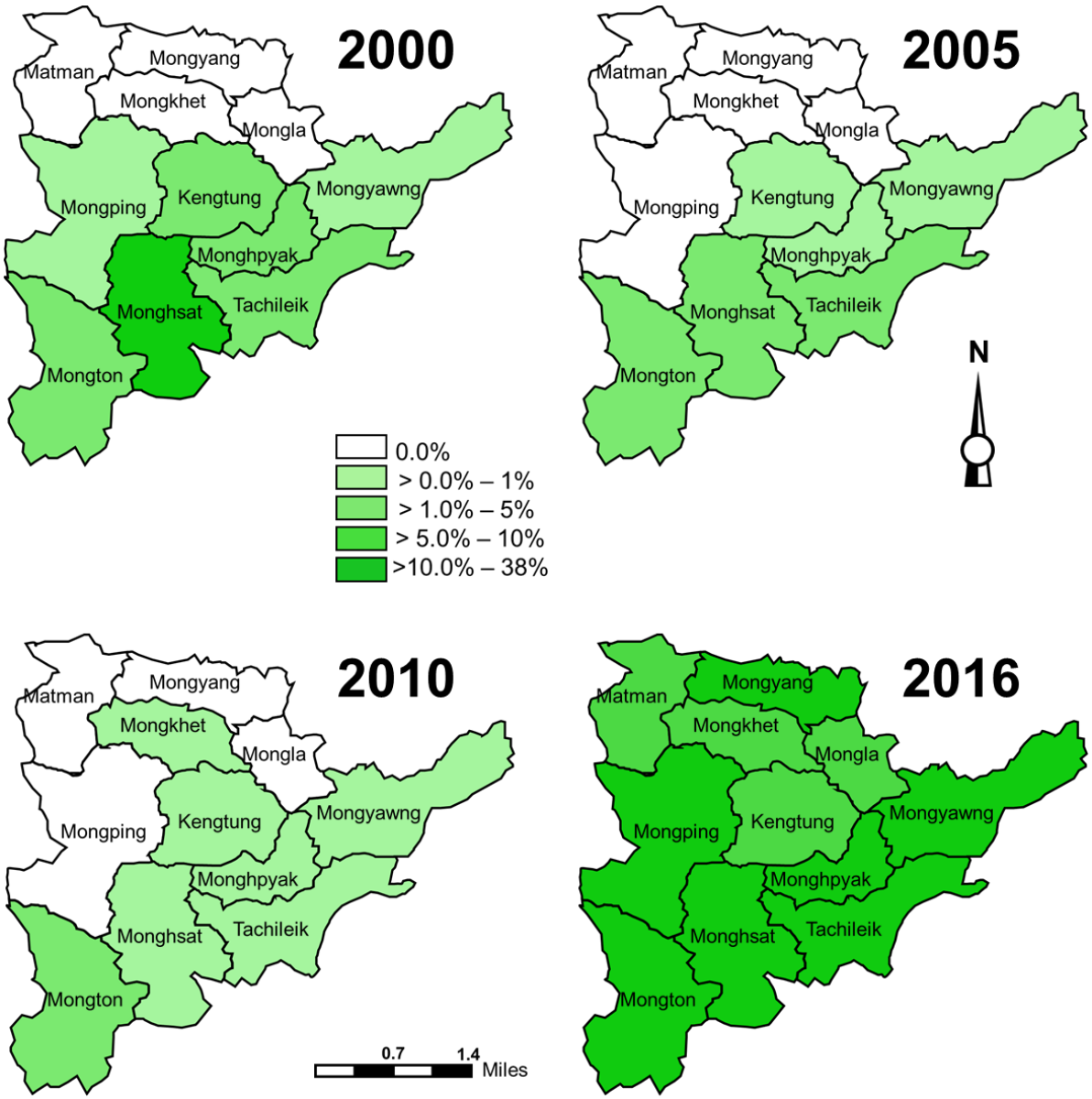

Figure 3. Annual blood examination rates (ABER) in Eastern Shan State according to township, 2000, 2005, 2010 and 2016

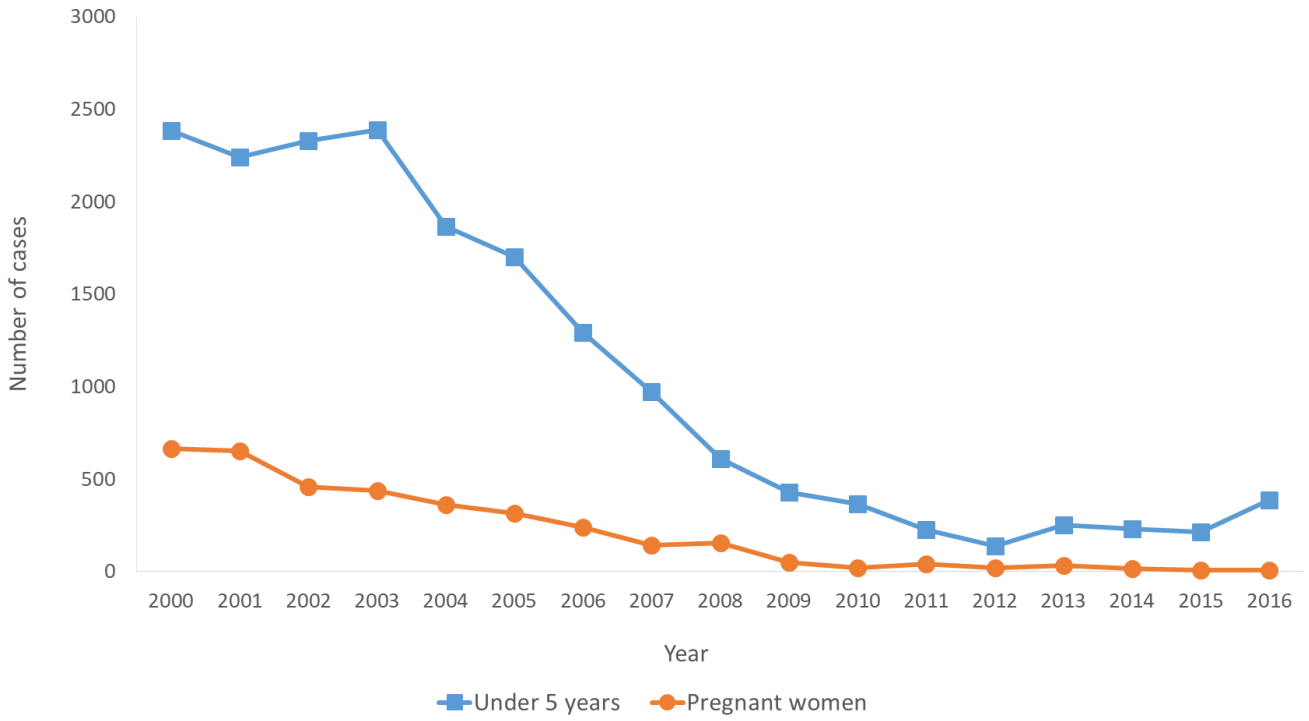

Figure 4. Number of malaria cases among children aged less than 5 years old and pregnant women in Eastern Shan State, 2000-2016

Discussion

The decreasing trends in malaria morbidity, mortality and case fatality rate in Eastern Shan State during 2000-2016 coincided with the expansion of three key interventions: the distribution of long-lasting insecticidal nets (LLINs), early malaria diagnosis and effective treatment. This finding is consistent with other studies conducted in Africa where a dramatic decline in malaria burden was due to the effective vector control measures and scaling up of artemisinin-based combination therapies (ACT) as first line anti-malarial drugs.[7-9] The increase in morbidity rates during 2012-2016 might be due to the increase in reporting rates. This finding is consistent with a study conducted in South Sudan during 2006 and 2013 where a gradual increase in the number of malaria cases was due to improvement of the surveillance system and increasing reporting rates.[10] Human migration is another possible factor that might contribute to an increasing number of cases during that period because migrant workers are highly exposed to poor housing which lack preventive measures such as LLINs.[11]

Total patient attendance at a health facility due to any illness during 2000-2016 increased by 57%, whereas malaria patient attendance decreased by 77%. Therefore, reduction in malaria cases might not be due to a decrease in accessibility. However, accessibility of health services is still challenging for those who live in remote areas of the state. We observed changing patterns of malaria seasonality in 2015-2016, i.e. having two peaks of reported cases as compared with only one peak in other years which might be due to environmental factors, such as temperature and humidity which can affect vector densities. This finding is consistent with the seasonal patterns in other states/regions of Myanmar.[12] A study conducted in Burkina Faso on data recorded during 1999–2003 revealed that the highest malaria mortality was during and at the end of the wet season when the transmission intensity of malaria is at its highest.[13]

Malaria morbidity and mortality varied widely between townships. This might be due to the varying ecological conditions. Mong Tong Township retained its position as the township with the highest malaria rates for a decade. In 2000, all townships had low ABER indicating low coverage of diagnostic and treatment services. In 2016, there was improvement in case finding as ABER increased from 2.0% to 12.5% by intensification of case finding through mobile clinics, expansion of health facilities in special regions, capacity building of basic health staff and VHVs and increased reporting by NGOs.[3]

Similar to other studies conducted in Myanmar, males and adults had higher malaria incidences compared to females and other age groups, respectively, which might be due to occupation and

behavioral patterns that cause a greater exposure to vectors.[7] The proportion of malaria in children under 5 years old was fairly constant at around 10%, indicating a persistent local transmission. The number of reported malaria cases among pregnant women also decreased during the study period, which probably indicates a more effective integration of maternal and children health care and malaria programme.[2] The gender and age distribution pattern of malaria in Myanmar is different from the African settings where younger age group and pregnant women are the most affected populations.[14]

Blood examination by microscopy decreased whereas the use of RDTs increased. This could be because microscopy can be performed only at hospitals whereas RDTs can be used in all health facility levels.[4] Regarding parasite species, since bivalent RDT was used throughout 2011-2016, we can assume that the proportion of *P. vivax* increased due to the high sensitivity of *P. falciparum* to artemisinin-based combination therapy. Prior to 2011, the proportion of *P. vivax* infections was low because only monovalent RDT, which can detect only *P. falciparum*, was in use.[4] This study supports the increasing roles of VHVs and NGOs in diagnosing malaria with RDTs, treatment with artemisinin-based combination therapy and reporting in 2015-2016.

Limitations

Due to data unavailability, we could not describe the distribution of malaria by gender, age and species before 2011. Limitations in use of health facility data in assessing trends in malaria should be kept in mind, especially in terms of service utilization and completeness of reporting. However, with the available data, we could describe the trends of malaria indicators and identify differences in malaria epidemiology between townships which may be useful for better prioritization and targeting implementation.

Conclusions

The findings revealed that morbidity and mortality of malaria in Eastern Shan State decreased over the period under review. Mong Tong and Mong Hsat Townships had the highest malaria incidence. Malaria morbidity varies according to gender and age with males and those aged more than or equal 15 years old showing a higher incidence. Case detection rates increased over time in all townships due to increasing roles of village health volunteers and NGOs and introduction of rapid diagnostic tests.

Recommendations

Routine malaria surveillance should be strengthened to ensure complete and timely reporting from all health sectors including public and private health facilities, NGOs, and Ethnic Health Organizations. Transmission reduction activities such as intensification of case detection in hard-to-reach areas, early case detection, appropriate treatment and effective vector control measures should be scaled-up to be ready for malaria elimination. Strong political commitment should be maintained with adequate financial support for malaria elimination.

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Suggested Citation

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