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Malaria Surveillance at Thai-Myanmar Border, Mae Sot District, Tak Province, Thailand, July 2013

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Abstract

Malaria epidemic along Thai-Myanmar border is still an ongoing occurrence. We explored malaria surveillance systems in Mae Sot District in order to improve the detection and response efforts in the region. The main objective was to study effectiveness of the malaria surveillance systems at Thai-Myanmar border. Data were collected by reviewing medical records, interviewing personnel at operation levels and observing the surveillance sites. The reporting system under Bureau of Epidemiology (BOE) was hospital-based, with 76% coverage, 100% positive predictive value and 100% timeliness. It was acceptable and stable, yet less flexible. The reporting system of Bureau of Vector Borne Disease (BVBD), existed from the village level, was used to obtain information for malaria prevention and control. The reports were sent via online malaria database system. Its sustainability could be affected by withdrawal of the Global Fund. Information of both systems was closely linked at the hospital (district) level. At border areas, health personnel regularly shared information through buddy health volunteers from both countries. Collaboration between epidemiology and information technology units should be strengthened in BOE and the reporting forms should be simplified by BVBD. The central Thai government should consider how to sustain the malaria surveillance and response system in the long run.

Keywords: malaria, surveillance, cross-border

Introduction

Malaria has been a leading cause of morbidity and mortality in Thailand for many decades. All four types of malaria are prevalent in the country. Malaria epidemics occurred periodically in high risk areas, especially along Thai-Myanmar and Thai-Cambodia borders. Non-immune migrant workers are the most vulnerable and most affected.[1]

In 2010, annual parasite index was 0.4 per 1,000 population, and total 22,342 Thai cases and 21,969 non-Thai cases were reported. About 68.0% of Thai cases and 96.0% of non-Thai cases were from Thai-Myanmar border.[2]

An effective malaria surveillance system is useful and important for identifying trends of malaria cases and deaths, early detection and respond to outbreaks, and planning prevention and control activities.[3,4]

The malaria surveillance system in Thailand composes of two reporting systems, including the national notifiable disease surveillance system of the Bureau of Epidemiology (BOE), and the national malaria control program of the Bureau of Vector

Borne Disease (BVBD) (Figure 1). Malaria data at the community level were reported to the systems by health volunteers.[5]

This study on malaria surveillance systems was conducted by the International Field Epidemiology Training Program (IFETP)-Thailand, in collaboration with the ASEAN Plus Three Field Epidemiology Training Network[6], at a border district.

The objectives of this study were to study effectiveness of the malaria surveillance systems by describing quantitative and qualitative attributes of the national disease surveillance system of BOE, and qualitative attributes of the BVBD reporting system; exploring the linkage between BOE and BVBD systems; and the collaboration for malaria surveillance between Thailand and Myanmar.

Methods

Study Design

A cross-sectional study was performed, with description on purposes, population under surveillance, resources, processes, operations, information dissemination and usefulness of the systems.

Assessment included estimation of coverage or sensitivity, positive predictive value (PVP), timeliness, simplicity, flexibility, stability, data quality and duplication. The coverage and PVP were described as percent.[7]According to the BOE guideline, timeliness of malaria reporting, the duration from date of diagnosis in hospital or health center to date of data received in the bureau, should be within one week.[8]

Data Collection

The study site was in Mae Sot District, Tak Province, Thailand. A malaria case was a patient who visited Mae Sot Hospital during January to December 2012, was diagnosed (ICD-10) and confirmed as malaria by blood smear or rapid diagnostic test.[9]

Medical records and reports from Mae Sot Hospital, Tak Provincial Health Office (PHO) and notified database were reviewed. Regarding quantitative attributes of the BOE system, sample size for coverage estimation was 240 medical records and PVP estimation was 76 reports.[10,11]

For qualitative assessment of both systems, total 26 persons were interviewed, including staff from Mae Sot Hospital, district health office, health center and port health office, provincial vector borne disease control center (VBDC 9.3), district vector borne disease control unit (VBDU 9.3.1), malaria clinic (MC), malaria post (MP), border malaria post (BMP) and health office at border checkpoint.

Results

Mae Sot District is located in western Thailand and borders with Myawaddy Township of Kayin State, Myanmar. Total area is 1,986 km^2, with the population of about 119,835 Thai and over 100,000 migrants.

There were 88 villages in total 10 sub-districts. One general hospital (420 beds), 22 health centers, eight MC, 10 MP, three BMP, one private hospital (120 beds) and 18 private clinics were situated in the district.

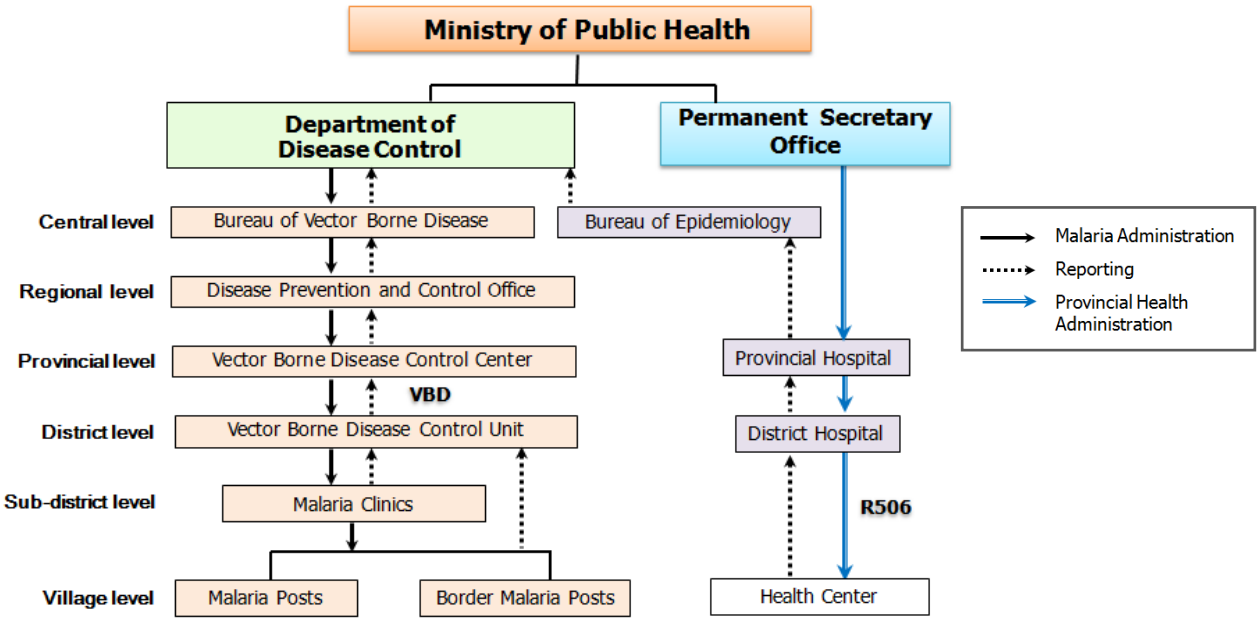

Figure 1. Description of malaria surveillance systems in Thailand[4], 2012

Reported Malaria Cases

During 2012, total 122 malaria cases from Mae Sot were reported in the BOE system while majority of them were Thai. The total number of cases reported in the BVBD system was 1,034, and 82.1% of them were reported from MC and MP (Table 1). Of 1,034 cases, 265 cases were Thai and 769 were foreigners.

Table 1. Malaria cases reported in district hospital (R506) and district vector borne disease control unit (VBDU), Mae Sot District, Tak Province, Thailand, 1 Jan to 31 Dec 2012

Source	R506	VBDU
Hospital	117	119
Health center	5	0
Malaria clinic	-	623
Malaria post/ Border malaria post	-	226
Active case detection	-	66
Total	122	1,034

About 76.0% of cases reported in the BOE system were infected with *P. vivax* and 24.0% were *P. Falciparum*. In the BVBD system, 811 (78..4%) cases with *P. vivax*, 220 cases (21.3%) with *P. falciparum* and three cases (0.3%) with *P. malariae were reported*. Proportion of *P. falciparum* and *P. vivax* from 2008 to 2012 showed a reversing trend in both surveillance systems (Figures 2 and 3).

The BOE System

Purpose and Usefulness

In the reporting system of BOE, information on diagnosis, treatment and follow-up was used to describe the epidemiology of malaria in Mae Sot District and guide actions in reducing malaria burden, complications and deaths. In addition, data of in-patients were filled in the epidemiological reporting form 3 (EP-3) and sent to VBDC for timely response.

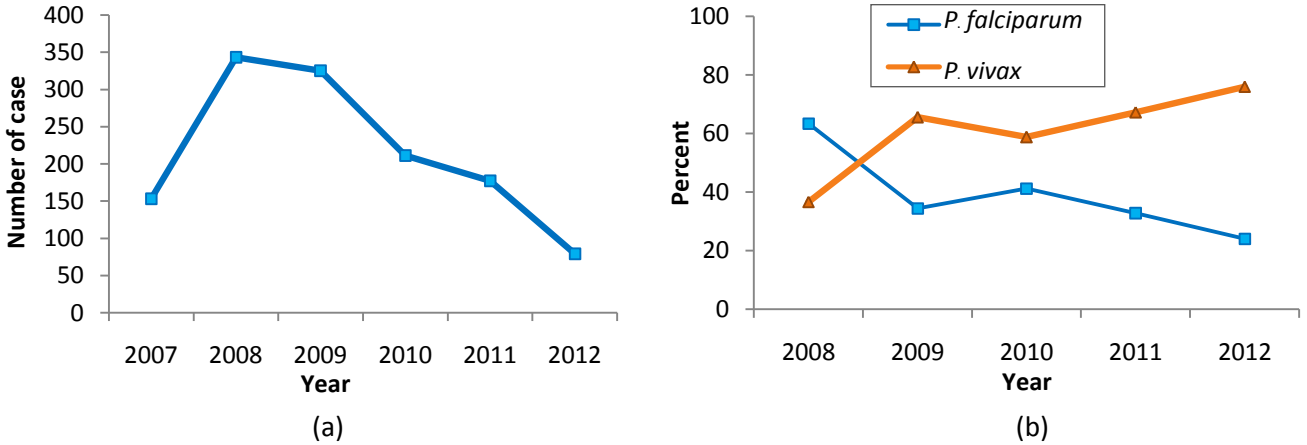

Figure 2. Malaria cases (a) and proportion of malaria species (b) reported from Mae Sot District, Tak Province to Bureau of Epidemiology, Thailand, 2007-2012

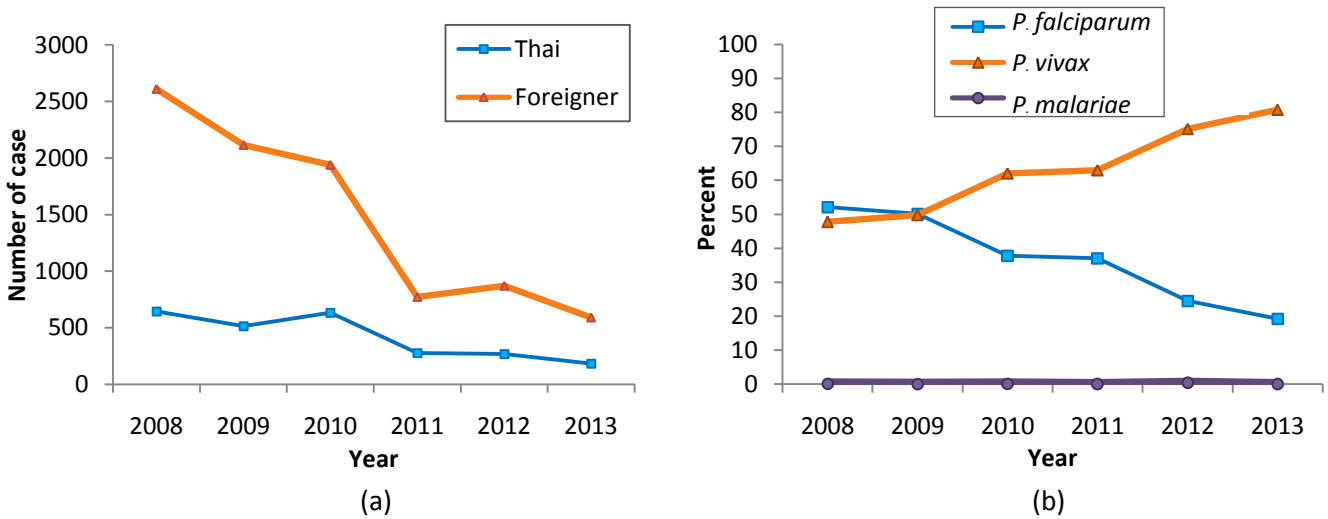

Figure 3. Malaria cases (a) and proportion of malaria species (b) reported from Mae Sot District, Tak Province to Bureau of Vector Borne Disease, Thailand, 2008-2013

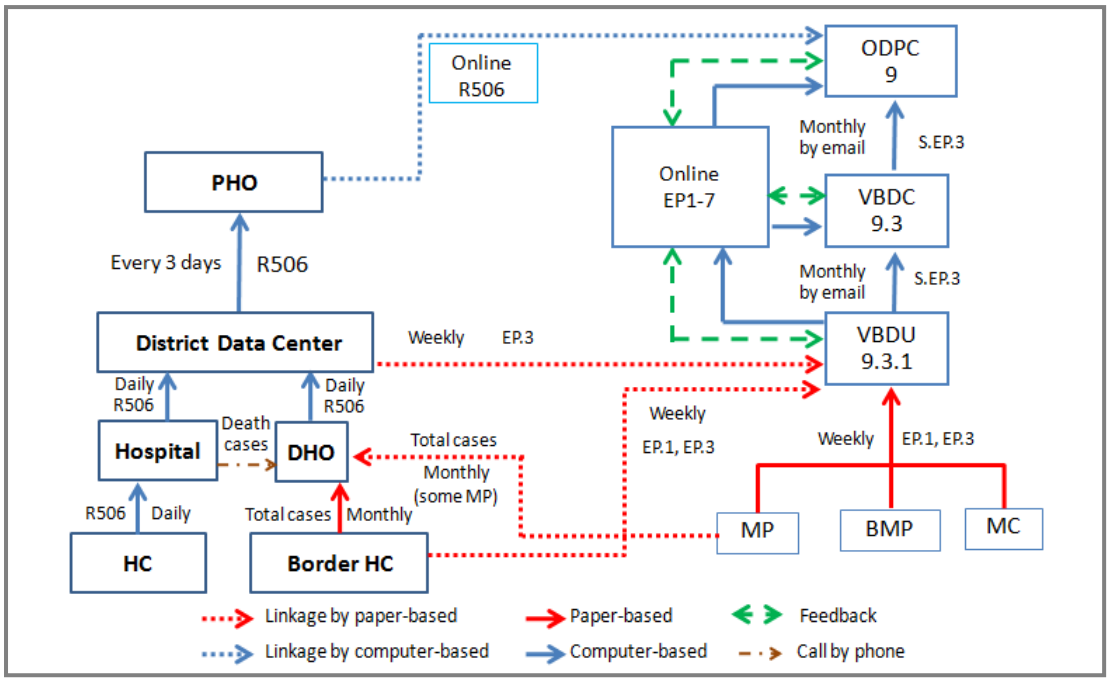

Figure 4. Description on reporting and data dissemination of malaria surveillance systems in Bureau of Epidemiology and Bureau of Vector Borne Disease, Thailand, 2012

Process and Operation

The BOE reporting system was based in health facilities. When patients visited Mae Sot Hospital, they were registered using HOSxP software, including information on diagnosis and treatment. The epidemiologist in the hospital extracted data from the HOSxP database by E1 form and reported in the BOE system. Afterwards, data were entered in EP-3 forms for malaria cases, which were collected by a staff from VBDU every Friday. If an admitted patient was found to have *P. falciparum*, the case was immediately reported to VBDU 9.3.1 to initiate an investigation.

In case a malaria patient who was living out of Mae Sot District was identified, the epidemiologist in the hospital reported to the respective VBDC office in the area where the patient was residing. After data were cleaned and entered into a notification form of BOE, information was sent to district data center and submitted to PHO every three days (Figure 4).

Data from health centers at the sub-district level were sent to the district health office (DHO) using the online BOE system in daily basis. Data from MP situated in mountainous or hard-to-reach areas were sent to DHO through epidemiological reporting forms, EP-1 and EP-3, on monthly basis. In DHO, the data were collected, checked, finalized and sent to the district data center every day by BOE system. Data in BOE[12] were accessible by the regional offices of disease prevention and control (ODPC) and other VBDC.

Coverage and PVP

Total 173 malaria cases from the inpatient department (IPD) were identified from ICD-10 database of Mae Sot Hospital. A total of 168 medical charts were reviewed and 138 cases met the case definition (CD).

Out of 62 cases from the outpatient department (OPD), there were 30 cases with available OPD cards and laboratory confirmation. Therefore, total 168 malaria cases were confirmed. Out of 154 cases met the reporting criteria, 117 cases were reported at the hospital level and coverage was76.0% (Figure 5).

During the study period, BOE received 103 reports of malaria cases from Mae Sot District. Out of them, 76 medical records were available for review and all met the case definition. Thus, calculated PVP of the BOE system was 100% at the central level.

Timeliness and Data Quality

Out of 76 cases reported to BOE, two cases reported before date of diagnosis were excluded. About 93.0% of cases were reported in one day while 100% were reported to BOE within one week, which was aligned with the timeframe indicated in the BOE guideline.[8]

Gender, age, onset date (+/-2 days) and nationality were compared between medical records and information at the hospital, provincial and central. Data quality was 100% for gender, 96.0% for age and 87-91% for nationality. Discrepancies of onset date between medical charts and the notification records existed, with 52.0% accuracy of the onset date.

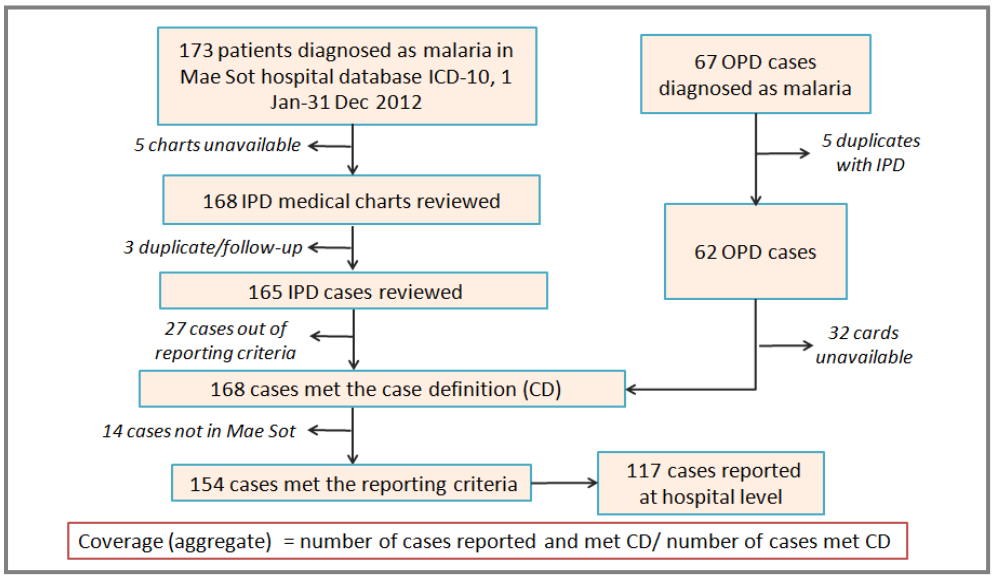

Figure 5. Process on estimating coverage of the malaria surveillance system in Bureau of Epidemiology, Thailand, 2013

Simplicity and Flexibility

According to information from interviews, the reporting forms of the BOE system were easy to fill in and utilize the information. As the online reporting software of the BOE system was linked to HOSxP, the data recorded were automatically reported and was able to analyze easily.

In addition, results were disseminated weekly through the BOE website[12]. However, it was not easy to add new information in the reporting forms due to limitation of the software which was designed at the national level.

Stability

Manpower was adequate to operate the BOE system at the hospital (4 officials), DHO (3 officials) and health center (2 officials). Budget and materials were supplied by the government at all levels. Data back-up system existed at the surveyed reporting units of all levels. In addition, there were external funding sources from World Health Organization (WHO) and European Union (EU) to support the special projects. Although annual training was provided to officials in the hospital, only two out of three sites at the DHO received training.

The BVBD system

Purpose and Usefulness

Information in the BVBD system was used mainly for malaria prevention and control. Villages in Mae Sot were classified for malaria risk[13] in 2012 and resulted as 32 villages in A1, 27 in A2, 29 in B1 and 20 in B2. In addition, information was used to develop plan for annual relocation of medical staff and MP to endemic areas, entomology survey and health education before the epidemic season.

The VBDC weekly compared the reported cases with data from the previous year for outbreak detection and response. If higher number of cases was reported in A1 and A2 areas, or one indigenous case was found in B1 and B2 areas, VBDU was informed to conduct an investigation in the affected village. Subsequently, a special case detection official from VBDU was dispatched with a mobile malaria clinic for screening, testing and providing health education in the communities.

Process and Operations

In the BVBD system, information collected in villages were sent as case reports to VBDU 9.3.1 weekly, with EP-1/EP-3 from MP, EP-1 from BMP and EP-1/EP-3 from MC. In VBDU 9.3.1, data were collected from all sites, including the district hospital, consolidated by computer-based forms (S.EP-3) and sent to provincial VBDC 9.3 by email monthly (Figure 4).

In VBDC 9.3, malaria data from nearby districts were also aggregated and sent to ODPC 9 in Phitsanulok Province using S.EP-3 forms on monthly basis. There were seven types of epidemiological reporting forms in VBDC 9.3 (Table 2).

The VBDU 9.3.1, VBDC 9.3 and ODPC 9 uploaded and shared all malaria data (EP-1-7) on the website of BIOPHICS (the centre of excellence for biomedical and public health informatics) at <www.biophics.org/malaria/r10>.[14] The website was a project under Mahidol University in cooperation with BVBD and supported by Global Fund (GF).

Table 2. Types of epidemiological reporting forms in Bureau of Vector Borne Disease, Thailand, 2012

Form	Description	Type of data
EP-1	Blood record form	Individual
EP-2	Monthly report of malaria case detection	Aggregate
EP-3	Investigation and radical treatment of malaria cases	Individual
EP-4	Monthly report of investigation and radical treatment of malaria cases	Aggregate
EP-5	Report of malaria focus investigation	Individual
EP-6	Malaria case registration	Individual
EP-7	Summary of surveillance operations	Aggregate

Simplicity and Flexibility

Case definition of malaria was known at every level. The reporting forms of BVBD were easy to be used by personnel in BMP and VBDU. However, at VBDC, there were many forms with many variables to fill in while some of these variables were duplicated. Laboratory and information technology (IT) staff could not fill data in the forms since they did not have enough information or knowledge on epidemiology, surveillance system and the malaria control program.

In VBDU, data were filled in manually and entered into the "Malaria off-line" software. Data were easy to analyze, interpret and disseminate by IT staff in VBDU and VBDC; and easy to generate new reports using the online system. Despite that, users of BVBD reporting system could not add new information into the standard questionnaires.

Stability

Sustainability of resources supported by GF could be an important issue to be considered when the support was likely to terminate at the end of 2016. At the village level, when the responsible staff was absent, there was no additional staff for replacement. In VBDU and VBDC levels, although some workers were available to assist in laboratory and IT, there was no additional staff to replace the epidemiologist.

For the resources, two major stakeholders, the Thai government and GF, were providing support to the sub-district level. However, MP, BMP, MC at the village level received support only from GF through Tak PHO and ODPC 9 (Table 3). Trainings on epidemiology and surveillance were provided for epidemiologists regularly. Nevertheless, laboratory and IT staff were trained less frequently.

Cross-border Malaria Surveillance System

The port health office for the border area between Mae Sot and Myawaddy Districts was located in Thailand. The main function of the office was to detect sick migrants who were provided with a screening form and asked to bring the forms back to the office after they got diagnosis and treatment from health facilities. The office sent a summary report to ODPC 9 and the international disease section in Bureau of General Communicable Disease, Ministry of Public Health. If needed, the office contacted staff in Myawaddy Hospital for detailed case investigation by phone or via Myanmar village chief.

In addition, there were buddy health volunteers at 33 informal ports along the river border with many parallel villages in both sides. Myanmar buddy health volunteers shared information with Thai buddy health volunteers who then reported to health center and DHO. DHO was prompted to inform and response if abnormal events occurred. DHO also shared and verified information with Myawaddy Hospital via a Myanmar coordinator in the port office. Afterwards, staff in Myawaddy Hospital would verify data through the line of management. Normally, hospitals in Myawaddy and Mae Sot shared information via phone call.

Table 3. Resources utilized for the malaria surveillance system in Bureau of Vector Borne Disease, Thailand, 2012

Type of resource	Malaria post/ Border malaria post	Malaria clinic	Vector borne disease control unit	Vector borne disease control center
Incentive	-	-	GF	GF
Salary	GF	Gov	Gov, GF (IT)	Gov, GF (IT)
Laboratory equipment	GF	Gov	Gov, GF, others	Gov, GF
Material	GF	Gov	Gov, GF, others	Gov, GF
Medicines	Gov	Gov	Gov	Gov

Remark: Gov = Government, GF = Global Fund

Discussion

The BVBD system revealed a decreasing trend of malaria cases among non-Thai during 2010 to 2011, which could be due to intensified malaria control activities in Myanmar under the support of GF[15]. In addition, effective treatment might lead to lower *P. falciparum* cases when compared to those with *P. vivax*, with intensive intervention and better patient compliance[16].

Data from the BVBD system were collected from both health facilities and communities. The system provided more representative information for magnitude of malaria problem as non-Thai cases and patients from MC and MP were included in the system. Surveillance offices covered most sub-districts, enabling early detection and treatment. Furthermore, the malaria online component allowed public to access to data which could be useful for rapid responses. However, the BVBD system was mainly supported by GF. Once the support from GF was terminated, sustainability could be affected, especially the IT system. In the BOE system, as malaria was included together with other notifiable diseases, the sustainability revealed higher despite less flexibility and lower sensitivity.

Incomplete coverage of the BOE system in malaria reporting was likely to be related to technical (software) issues, and coordination between IT and surveillance staff. Connection problems existed occasionally between HOSxP and the software of BOE. During 2012, different numbers of malaria cases were reported at district data center, Tak PHO, and BOE.

High PVP of the BOE system might be due to simple definitions for case diagnosis and reporting which were understandable at all levels. Clearly established criteria for timeliness and schedule for data submission might contribute to the satisfying timeliness as well. Data quality in general was acceptable, except accuracy of onset date. Discrepancy of onset date between medical charts and hospital notifiable records could be caused by language barrier or inconsistency of patient responses at OPD and IPD.

As VBDC and VBDU were the main sectors to respond to malaria outbreaks, functioning of the BOE system relied on the BVBD system as well. While reports in the BOE system reflected hospital-based situation, the BVBD system indicated malaria situation in both hospitals and communities.

Involvement of Thai and Myanmar community volunteers across the border as buddy health volunteers rendered wider coverage of malaria surveillance, led to early detection and prompt response of abnormal events, and enhanced disease control and prevention activities.

Limitations

The geographical scope was limited in this study as it only focused on a border district. Although all staff from the district level were interviewed, only a few offices in sub-district and villages were reached out for information. Moreover, coverage, PVP, timeliness and data quality were estimated only for the BOE reporting system.

Conclusion

Two malaria surveillance systems in Mae Sot District, the BOE and the BVBD, perform well as border surveillance systems. Review on both systems provided a comprehensive description of malaria situation in this area. Acceptable performance of the BOE surveillance system was observed while the BVBD system was useful for providing a more complete picture of malaria situation. However, sustainability might be affected by termination of resources from the GF.

Recommendations

In the BOE surveillance system, close collaboration between epidemiology and IT units for routine checking on data validity of the automatic program was recommended. In addition, optional case finding after completing IPD medical records should be considered, especially after long holidays or power outage, to increase the reporting coverage.

Reporting forms in the BVBD system should be simplified to reduce workload. In addition, feedbacks from users should be periodically reviewed to improve reporting and control actions. Sustainable support for the malaria online database and local MP should be seriously considered. Training of laboratory and IT staff for epidemiology and the surveillance system should be conducted as well.

The officials working on both systems should be encouraged to carry out regular internet-based data cross-checking and validation using online databases from the websites of BOE[12] and BIOPHICS[14] to avoid data discrepancies between the two systems. Formal or informal communication between cross-border checkpoints, local health offices and community-based buddy health volunteers should be supported and strengthened further.

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