



Field Evaluation of the Syphilis Surveillance System at Mae Sot Hospital, Tak Province, Thailand

Yu Nandar Aung^{1*}, Ni Win Htike², Min Myo Kyi³, Chanodom Piankusol⁴, Sahrol Azmi Terlmizi⁵, Kosal Sreang⁶, Thanawadee Chantian⁷, Onpirun Sagarasearane⁸, Bencharong Sangkharak⁹, Purnama Martha Oktavia Simanjuntak¹⁰, Khanuengnij Yueayai¹¹, Rapeepong Suphanchaimat^{7,12}, Pitikhun Setapura⁷, Thanit Rattanathamsakul⁷

1 East District Public Health Department, Yangon, Ministry of Health and Sports, Myanmar

2 Aunglan Township Public Health Department, Ministry of Health and Sports, Magway, Myanmar

3 Vector Borne Disease Control Division, Ministry of Health and Sports, Kayin State, Myanmar

4 Faculty of Medicine, Chiangmai University, Thailand

5 Pahang State Health Department, Ministry of Health, Malaysia

6 Department of Communicable Disease Control, Ministry of Health, Cambodia

7 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

8 Division of Communicable Disease, Ministry of Public Health, Thailand

9 Department of National Parks, Wildlife, and Plant Conservation, Ministry of Natural Resources and Environment, Thailand

10 Directorate of Animal Health, Ministry of Agriculture, Indonesia

11 Office of Prevention and Control 9, Department of Disease Control, Ministry of Public Health, Thailand

12 International Health Policy Program, Ministry of Public Health, Thailand

*Corresponding author, email address: girlyunandar2012@gmail.com

Abstract

Evaluation of the syphilis surveillance system was conducted at Mae Sot Hospital, Mae Sot District, Tak Province, Thailand during 13-16 Aug 2019. The objectives of the evaluation were to describe the usefulness and to evaluate the performance of the system. A cross-sectional study was carried out to assess the reporting system of syphilis. Medical records were reviewed from all possible data sources. Semi-structured questionnaires were used for in-depth interviews with a policy maker, health care providers, laboratory technicians and information and technology personnel. The sensitivity of reporting syphilis cases into Thailand's national notifiable disease surveillance reporting system was about 67%, while the positive predictive value of reporting was reached 100%. The data quality of reporting reached almost 100%. The reported data represented the true cases in terms of sex and age. The majority of participants found the reporting system of syphilis cases to be useful, acceptable, simple and stable. The majority of missed reported cases were migrants. Incomplete diagnosis and coding were key concerns. The Epidemiology Unit at the hospital should analyze Thai and foreign cases separately to represent the true situation in the border area. Cooperation amongst within-hospital units for better capture of syphilis cases in hospital is recommended.

Keywords: syphilis, surveillance system, reporting system, Thailand

Introduction

Syphilis is a bacterial infection caused by *Treponema pallidum*. It is transmitted via sexual contact of mucous membranes or abraded skin, via the placenta of a pregnant woman to her foetus, or via a blood transfusion. The disease has four stages: (1) primary syphilis, (2) secondary syphilis, (3) latent syphilis, and (4) congenital syphilis.¹ According to a World Health Organization report, there were approximately 17.7 million syphilis cases among people aged between 15 and 49 years worldwide in 2012.² In 2017, the prevalence of syphilis among antenatal care attendees ranged from 1.0-8.0% in 37 of 83 reporting countries; over 5.0% of sex workers were infected in 18 of 31 reporting countries; and the prevalence of infection was 5.0% greater among men having sex with men in 22 of 34 reporting countries.³

An overview of syphilis in Thailand found that the prevalence has increased dramatically since 2000 despite a significant decrease in syphilis cases in the 1990s. From 2005 to 2011, significant increases occurred in the annual prevalence of HIV (from 24.6% to 29.4%) and syphilis (from 5.0% to 12.5%).⁴

In 2018 there were a total of 177 cases of syphilis in Tak Province. Among them, Mae Sot District was the most prevalent area, accounting for 120 cases (68%), of which 70% were non-Thais and were mostly labourers and students.⁵ Mae Sot is a District with one of the highest incidence and prevalence of syphilis in Thailand. Moreover, the surveillance system of syphilis has never been officially evaluated in Thailand. This study is therefore likely to be one of the first studies that scientifically evaluated the syphilis surveillance system in Thailand through a case study of Mae Sot Hospital.

Mae Sot District, Tak Province, is situated in the northwest region of Thailand. The total area accounts for about 1,986 km² with 119,835 Thai citizens and more than 100,000 migrants. Mae Sot is the largest urban center along the Thailand-Myanmar border and has been rapidly changing from a small border town to a large special economic zone.

As currently the rise of syphilis cases is one of the key public health concerns nationwide and this situation is also pronounced in Mae Sot District, the evaluation of the syphilis surveillance system in Mae Sot Hospital is likely to be beneficial to identify potential gaps in the service and reporting system. Also, it is hoped that the study can serve as an example for other health

facilities in Thailand how the evaluation of chronic communicable diseases such as syphilis can be performed.

Thus, the objectives of the evaluation were to describe the usefulness of the syphilis surveillance system and evaluate its performance at Mae Sot Hospital via selected quantitative and qualitative attributes and provide practical recommendations to improve the surveillance system for the hospital.

Methods

Study Design

This study applied a cross sectional design. Both quantitative and qualitative attributes were assessed. The evaluation was divided into two elements: (i) description of the operating process of the syphilis surveillance system, and (ii) evaluation of the performance of the system and its usefulness.

Study Site

The evaluation of the syphilis surveillance system was conducted in Mae Sot Hospital, Mae Sot District, Tak Province, Thailand.

Study Period

The field study was performed during 13 to 17 Aug 2019. The period of interest ranged from 1 Jan 2018 to 31 Dec 2018.

Data Collection Techniques and Participants

System description

A qualitative approach was used in this element. In-depth interviews and observations were the main data collection techniques. The research team interviewed the hospital staff involved with the reporting system and observed their work process. The interviewees were asked to describe the syphilis surveillance system, with a focus on its purpose, the flow of data, the resources used to operate the system, and the usefulness of the system.

Evaluation of the performance of the surveillance system and its usefulness

To assess the system performance, the research team focused on the following attributes: (i) quantitative attributes, comprising sensitivity (proportion of the reported true cases to the total true cases), positive predictive value (PPV) (proportion of the cases meeting case definition to the total reported cases), completeness (percentage completion of variables

entered in the reporting system), validity (number of matched medical records among the reported true cases), timeliness (duration from date of diagnosis to date of reporting; using a one-day window as a cut-off) and representativeness (comparing the number of cases meeting case definition and reported cases); and (ii) qualitative attributes, comprising simplicity, acceptability, stability, and flexibility. The system description and the usefulness were asked alongside the interviews for qualitative attributes.

For quantitative attributes, medical records were reviewed from the following data sources (i) HOSxP (according to the 10th version of

International statistical classification of diseases [ICD10]—such as congenital syphilis (A50.0-A50.9), unspecified late syphilis to neurosyphilis (A52.0-A52.3), other symptomatic late syphilis to late syphilis, unspecified (A52.7-A52.9), latent syphilis, unspecified as early or late (A53.0) and unspecified syphilis (A53.9), (ii) blood bank, (iii) antenatal care (ANC) unit, (iv) sexually transmitted disease and HIV (STI/HIV) clinic, (v) migrant health screening unit, (vi) serology laboratory logbook and (vii) pharmacy unit. Additionally, the research team reviewed data of newborns from mothers with syphilis at the labour room and paediatric unit; and reviewed data of the mothers of congenital syphilis cases in the HOSxP.

Table 1. Details of the respondents involved in the interviews

Position
1. Deputy director
2. Infectious disease medical specialist
3. Paediatrician
4. Medical obstetrician/gynaecologist
5. Epidemiologist
6. Epidemiology unit officer
7. Labour room nurse
8. Health screening unit nurse
9. Antenatal care nurse
10. Gynaecology unit nurse
11. Sexually transmitted disease (STI) clinic nurse
12. Serology laboratory technician
13. Blood bank officer
14. Information and technology (IT) officer
15. IT coder (1)
16. IT coder (2)

All data were coded into data extraction forms. Descriptive statistics were applied on quantitative data. The case definitions of syphilis were adopted from the Centers for Disease Control and Prevention (CDC) guidelines with slight modifications to match with evaluation process.

For qualitative attributes, in-depth interviews using semi-structured questionnaires were conducted on 16

respondents. The qualitative data were analysed by content analysis method. Details of the respondents are presented in Table 1.

The research team then performed an additional analysis to explore the demographic features of syphilis cases in Mae Sot Hospital. This included the distribution of cases by residential address and percentage of each stage of syphilis (primary,

secondary, latent and congenital). Unreported cases were traced back to the service sites and were identified for their characteristics. An additional search for syphilis from other ICD10 diagnoses that can mimic syphilis signs and symptoms, such as gonococcal infections (A54.0 – A54.9), chlamydial lymphogranuloma (A55), and other chlamydial infections (A56.0-A56.4, A56.8) was done.

Results

System Description

The data from the antenatal care (ANC) clinic, health screening unit, obstetric and gynaecological unit, paediatric unit, STI/HIV unit, inpatient department,

outpatient department and labour room were directly reported to the hospital information system (HOSxP). All records from these data sources were also transferred to the pharmacy unit for prescribing the treatments. Laboratory results from all service units in the hospital except the blood bank were sent to the laboratory information system.

The data from HOSxP were sent to the statistical group of the epidemiological unit within three days. Then, within one week, the epidemiology unit would code these data into Thailand's National Disease Surveillance System (henceforth R506) at the Epidemiology Division and Tak Provincial Health Office.

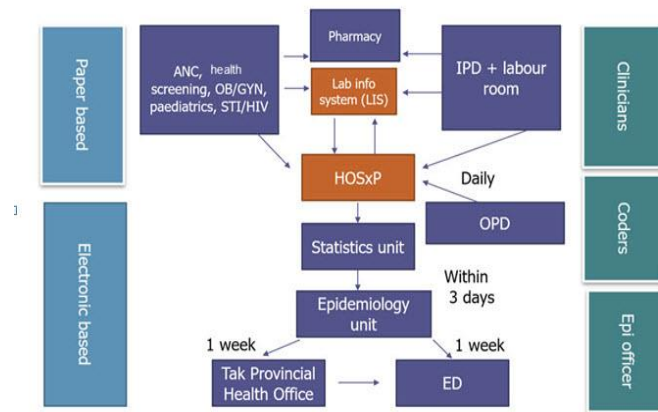


Figure 1. Description of data flow of the syphilis surveillance system at Mae Sot Hospital, 2018

Quantitative Attributes

The research team found that with all datasets combined and after deleting duplicates, a total of 375 cases met the inclusion criteria of which 175 met the case definition. Among these cases, 118 were reported

to R506. Table 2 shows a summary of all syphilis cases at the hospital.

Sensitivity

The sensitivity of syphilis reporting system at Mae Sot Hospital was 67.4% (118/175).

Table 2. Case summary of syphilis at Mae Sot Hospital, 1 Jan 2018 to 31 Dec 2018

	Met case definition	Did not meet case definition	Total
Reported in R506	118 (a)	0 (b)	118 (a+b)
Not reported in R506	57 (c)	200 (d)	257 (c+d)
Total	175 (a+c)	200 (b+d)	375 (a+b+c+d)

Positive Predictive Value

The positive predictive value of syphilis reporting system at Mae Sot Hospital was 100% (118/118).

Completeness

Completeness for age, sex, marital status, ICD10, nationality and occupation were reviewed. All reported cases had complete information on these variables.

Timeliness

Timeliness was measured by duration of time between date of diagnosis and date of reporting to R506. There were 111 from 118 cases (94.1%) that were reported to the R506 within a one-day window.

Validity

Sex, marital status, and diagnosis were all correctly coded. Age was incorrectly coded in one record (46 years in the R506 *versus* 34 years in HOSxP)

representing an accuracy of 99.2%. Nationality was incorrectly coded in 21 records giving an accuracy of 82.2%.

Representativeness

Sex and age in the R506 represented the sex and age information in HOSxP very well. A slight margin was observed between the two datasets. However, non-Thai nationality in the R506 under-represented the true cases by about 11.0% (Table 3).

Table 3. Representativeness of variables in the R506 compared to HOSxPat Mae Sot Hospital, 1 Jan 2018 to 31 Dec 2018

Characteristic	HOSxP	R506
Mean age (standard deviation)	31.0 (12.0)	31.2 (10.3)
Sex (n, %)	Male	65 (54.6)
	Female	54 (45.4)
Nationality (n, %)	Thai	26 (21.8)
	Non-Thai	93 (78.2)

Table 4. Summary of content analysis for qualitative attributes

Attribute	Positive n (%)	Negative n (%)	Neutral n (%)	Not applicable n (%)
Simplicity	10 (62.5)	1 (6.3)	4 (25.0)	1 (6.3)
Acceptability	11 (68.8)	1 (6.3)	4 (25.0)	0
Stability	9 (56.3)	1 (6.3)	4 (25.0)	2 (12.5)
Simplicity	10 (62.5)	1 (6.3)	4 (25.0)	1 (6.3)
Flexibility	3 (18.8)	4 (25.0)	3 (18.8)	6 (37.5)
Usefulness	13 (81.3)	0	2 (12.5)	1 (6.3)

Qualitative Attributes

The summary of results from content analysis is demonstrated in Table 4.

Simplicity

About 60% of the interviewees mentioned that it was not too difficult to operate the system. One of respondents reported that it was not easy for the system to provide disease information in non-Thais due to a lack of a unique identification number in some cases. Nearly a quarter of the interviewees said they were not involved in the all aspects of the system and

were not certain about its simplicity.

Acceptability

About 70% of the interviewees said that they accepted the system, though there were some operational difficulties. About a quarter of the respondents showed neutral opinions towards the system as they were not aware of the reporting system.

"I don't know about the system. I just examine and diagnose and treat the patients. I need specific guidelines, especially for non-Thai patients because the current guideline is mainly applicable for Thai patients." Medical obstetrician/gynaecologist

Stability

More than half of the respondents reported that the system was stable and easy to maintain because they had backup plans such as auxiliary manpower and contingency data storage on a cloud server. This system was also financially supported from the regular budget. One respondent mentioned that if there were more training sessions and more staff, the system could be improved, particularly for tracing patients lost to follow up. About 40% of the interviewees responded that they were not involved in the whole system and were not certain about its stability.

“The system is able to run smoothly. It is operated by a three-person team in which they can use the regular operating budget. Additional budget to maintain the system is not necessary.” Deputy director of Mae Sot Hospital

Flexibility

Approximately one fifth of the respondents said that the system was flexible. Any change in the case definition would not cause significant impact on the reporting system. However, about a quarter of the respondents expressed some doubts as to the flexibility of the system as it could not be integrated with other reporting systems and this issue was linked with the patients' confidentiality.

“I rarely merge the syphilis reporting system [with others] as this links to patients' confidentiality and commercial issues.” Blood bank officer

Usefulness

The majority of respondents mentioned that the system was useful. Information from the system was beneficial for case management, including follow-up planning.

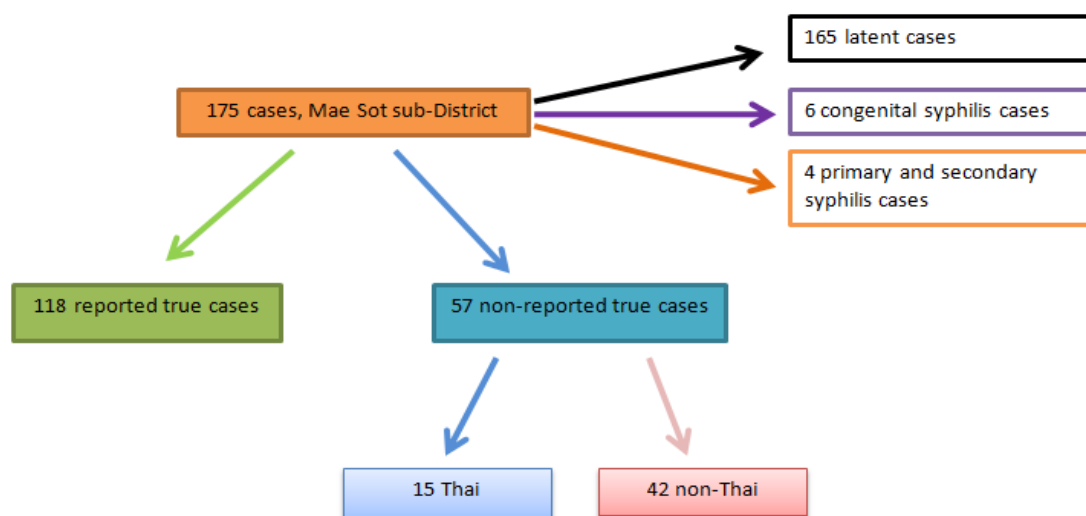


Figure 2. Diagram of detailed investigation on syphilis cases at Mae Sot Hospital, 13 to 16 August 2019

Additional Analysis

The evaluation team further investigated characteristics of the syphilis cases in Mae Sot Hospital. The cases were divided into sub-districts and nationalities. There were 19 Thais and 156 non-Thais among the 175 cases. As shown in Table 5 Mae Sot Sub-district had the largest prevalence of syphilis (for both Thais and non-Thais) compared to other areas.

After reviewing all 175 syphilis cases, 165 were latent (94.3%), 6 congenital (3.5%) and 4 were a combination of primary and secondary (2.3%). Among the six congenital cases, one was non-Thai whose maternal treatment was not available for review. For the other five cases, two appeared in the R506 while the other three did not.

Among the 57 cases meeting the definition of syphilis but not reported in the R506 (c in Table 2), 15 were Thai nationality while the other 42 were migrants. Among these, 11 did not receive any treatment (Thais = 3 and non-Thais = 8). Most of the non-reported cases were from the health screening unit. Incomplete ICD10 coding was noted in most non-reported cases.

The research team further examined the reports that originated from the blood bank unit. There were 33 cases (Thais = 14 and non-Thais = 22) that showed reactive Treponema Pallidum Haemagglutination Assay (TPHA), which suggested that these cases had a previous history of syphilis. All 14 of the Thai cases resided in Mae Sot District and eight tested weakly positive on the Venereal Disease Research Laboratory

(VDRL) test. Three cases had a high titer of VDRL (>1:8).

Table 5. Case distribution stratified by sub-district and nationality

Sub-district	Thai (n = 19) n (%)	Non-Thai (n = 156) n (%)
Mae Sot	7 (36.7)	45 (28.8)
Tha Sai Luat	2 (11.1)	38 (24.3)
Mae Pa	2 (11.1)	16 (10.2)
Mae Ku	0 (0.0)	15 (9.6)
Phra That PhaDaeng	1 (3.1)	13 (8.3)
Mae Kasa	2 (11.1)	11 (7.0)
Mae Tao	0 (0.0)	10 (6.4)
Mahawan	0 (0.0)	2 (1.3)
Phawo	2 (11.1)	1 (0.9)
Dan Mae La Mao	3(15.8)	0 (0.0)
Unknown	0 (0.0)	5 (3.2)

From the additional search for potential syphilis cases from other ICD10 diagnoses 97 suspected cases were identified, of which two met the definition of syphilis based on clinical findings. As shown in Table 6, both of these cases were recoded as gonococcal infection (A54).

Table 5. Additional search for syphilis from syphilis mimicking diagnoses

	Gonorr hea	Chanc roid	Rash & others	Total
Did not meet case definition of syphilis	12	3	80	95
Meet case definition of syphilis*	2	0	0	2
Total	14	3	80	97

Note: *One suspected primary syphilis and one suspected secondary syphilis

Discussion

A surveillance system evaluation is a critical and useful action to ensure that diseases with public health importance are appropriately monitored. The overall

sensitivity of the syphilis surveillance system at Mae Sot Hospital was 67.4% and the PPV was 100%. A high PPV suggests that the system did not lead to unnecessary resources used. The timeliness of the surveillance system at Mae Sot Hospital was 94.1%, denoting a timely management of disease prevention and control. This is likely due to the application of an electronic-based system that facilitates timely submission of data. This finding is consistent with an earlier study, which evaluated the Syndromic Surveillance System in six states in the US and found that the system provided near-real time data submission with a slight delay occurring because of the automated processing time for network transmission.⁶

The syphilis surveillance system at Mae Sot Hospital contained high quality data. Apart from the patient's nationality, the degree of data validity and completeness was high. For qualitative attributes, the system was useful, acceptable, simple and stable. This result is similar to a finding from an earlier study that evaluated the malaria surveillance system in Kanchanaburi Province.⁷ This suggests that the health sector in Thailand has performed well in operating surveillance systems on key diseases that may cause public health threats, such as malaria and syphilis.

The review of cases that might mimic syphilis signs and symptoms found that the risk history (for example sexual contact) and details of lesions (for example ulcer characteristics) were not well documented in the medical charts. This created some difficulties in judging whether the patient met case definition of syphilis. This barrier also hampered the research team in differentiating types of syphilis with the data in hand.

There were many unreported suspected cases from the blood bank registers. This was due to a lack of communication between blood bank staff and those responsible for the hospital reporting system and a lack of mechanism of the blood bank staff to encourage suspected donors return to the hospital to receive further blood testing. The latter is in fact the interaction between staff from the blood bank unit, the Red Cross and donors. However, the former is something that can be improved by strengthening the communication amongst the hospital subunits.

The proportion of unreported syphilis cases was higher amongst non-Thais than Thais. This is likely due to the routine health screening system for non-Thais. Migrant workers in Thailand are needed to undertake health screening as a condition to obtain a work

permit. Yet, in practice, many migrants (and employers of migrants) did not wait for the results of the screening. Sometimes the work permit issuance system was relaxed by allowing migrants to show only the evidence of undertaking health screening (such as receipt or medical bill) to fulfil the work permit condition. A better linkage of data between the health screening unit and the STI/HIV clinic is required to ensure better surveillance and treatment coverage for non-Thai populations.

For congenital syphilis, the pitfall of non-reporting was incomplete diagnosis where the newborns were recorded as a normal delivery without specifying congenital syphilis as a comorbidity. One study in northeastern Brazil found that about 39.0% of congenital syphilis deaths were not reported into the surveillance system.⁸ Another study in a low-incidence state in the US showed that about one third of newborns with probable congenital syphilis did not receive treatment.⁹

The blood bank data were separated from the HOSxP data by default. This is because normally the blood bank unit submitted the blood samples of donors to the Red Cross. Given positive results, the Red Cross would report the results back to the blood bank unit. The blood bank unit then contacted each individual donor by invitation letter. However, it solely depended on each individual whether he/she wished to return to the hospital for further checking.

This study faced some limitations. First, as our study focused on only one hospital and so is not representative of the whole country. Second, the research team did not explore the functions of private health facilities or non-governmental organizations. Third, the case definitions stipulated by the CDC and the R506 exhibited a slight difference. Therefore, if the readers wish to contrast this study's findings with others that applied a different case definition, the finding interpretation should be made with caution.

Conclusions

The sensitivity of reporting syphilis cases into Thailand's national notifiable disease surveillance reporting system in Mae Sot Hospital in 2018 was approximately 67% while the PPV was 100%. The data quality of reporting reached almost 100% in all variables. The reported data represented the true cases very well in terms of sex and age distribution, but not in terms of nationality. The majority of participants found the reporting system useful, acceptable, simple and stable. Incomplete diagnosis

and coding were the key concerns accounting for low sensitivity, and cooperation amongst within-hospital units (blood bank, sexually transmitted infection [STI]/HIV clinic, and antenatal care clinic) for better capture syphilis cases in hospital is recommended.

Public Health Recommendations

To enhance the sensitivity of the syphilis surveillance system in Mae Sot Hospital, the following actions are proposed.

- The physicians (or in-charge nurses, especially in the ANC and STI/HIV clinic) should be encouraged to document the diagnosis of syphilis more clearly (not only in the principal diagnosis but also as a comorbidity).
- The coders should be reminded to thoroughly search for syphilis, both in the principal diagnosis and comorbidity.
- The officers at the health screening unit should regularly check if the syphilis cases visit the STI/HIV clinic.
- The epidemiology unit should routinely conduct an in-house audit by including the engagement of relevant units such as pharmacy, ANC clinic and labour room.

Apart from enhancing the sensitivity of reporting, the hospital may consider enhancing the treatment of syphilis by implementing the following proposals.

- Requesting the blood bank staff to notify the STI/HIV clinic for cases testing positive for VDRL/TPHA in the donors (in addition to notifying individual donors by letters).
- Asking staff at the ANC clinic to notify the STI clinic whenever a case tests positive for VDRL/TPHA (either in pregnant women themselves or her partners);
- All patients presenting with STI signs and symptoms should have a VDRL and TPHA test.

Acknowledgements

We would like to thank all of the staff from Mae Sot Hospital and the Epidemiology Division for their active participation and assistance throughout the evaluation course.

Suggested Citation

Aung YN, Htike NW, Kyi MM, Piankusol C, Terlmizi SA, Sreang K, et al. Field evaluation of the syphilis

surveillance system at Mae Sot Hospital, Mae Sot, Tak Province, Thailand in 2018, conducted during 13-16 Aug 2019. OSIR. 2020 Dec; 12(4):144-152.

incidence state. *Arc Pediatr Adolesc Med.* 2001 Feb;155(2):140-4.

References

1. World Health Organization. *Nature Reviews Microbiology.* June 2004; 2:448.
2. Newman L, Rowley J, Vander Hoorn S, Wijesooriya NS, Unemo M, Low N, et al. Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting. *Plos One.* 2015 Dec 8;10(12): e0143304.
3. World Health Organization. Sexually transmitted infections [Internet] 2018. [cited 2019 Aug 8]. Available from: <<https://www.who.int/gho/sti/en/>>
4. Centre for Disease Control and Prevention, Atlanta. HIV and syphilis infection among men who have sex with men, Bangkok, Thailand, 2005–2011. *Morbidity and mortality weekly report.* 2013 Jun 28; 62:518-520.
5. Yingyong T. Introduction to R506 and syphilis surveillance system [unpublished lecture note]. IFETP, Bureau of Epidemiology, Ministry of Public Health, Thailand; lecture given 2019 Aug 6.
6. Mathew J, Paula W, James M, Arthur J, William R. Evaluation of syndromic surveillance systems in 6 US State and local health departments. *J Public Health Manag Pract.* 2018 May/Jun;24(3):235-240.
7. Mon Thet S, Rattanathumsakul T, Puangmanee D, Khine San K, ThanWint P, Wahab AB, et al. Field Evaluation of Malaria Surveillance System in Sai Yok District, Kanchanaburi Province, Thailand. *Outbreak, Surveillance, Investigation & Response (OSIR) Journal.* 2019 Jun; 12(2): 38-45.
8. Cardoso AR, Araújo MA, Andrade RF, Saraceni V, Miranda AE, Dourado MI. Underreporting of congenital syphilis as a cause of fetal and infant deaths in northeastern Brazil. *Plos One.* 2016 Dec 12;11(12): e0167255.
9. Martin D, Bertrand J, McKegney C, Thompson L, Belongia E, Mills W. Congenital syphilis surveillance and newborn evaluation in a low-