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Editorial

Improving Access to Treatment of Poisonings in Asia: Challenges beyond Availability

Viroj Tangcharoensathien, Winai Wananukul, Honarary Editors

Although NCD emerged rapidly and became the major contributors to the burden of disease in most of low and middle-income countries; governments cannot under-estimate certain communicable diseases which remain a serious public health threat; all of which require robust core competencies as required by the 2005 International Health Regulation. This OSIR issue highlights five articles related to key public health challenges. A chronological evolution of migrant policy in Thailand describes how the country responds to labour shortage while protects health of migrants. Four others are evaluation of malaria surveillance; Indonesian animal brucellosis surveillance; multiple cholera clusters; and investigation of scabies outbreak among prisoners. All these articles address the communicable diseases which continued to pose significant public health threats to countries in Southeast Asia.

In addition poisoning, snake bites and access to antidote and antivenom are among public health challenges that have not been widely discussed in public health communities. It is hoped that future OSIR issues will present articles on toxin and poisoning from the lens of outbreak investigation or public health response.

The burden of poisoning

Poisoning is one of the global health challenges. In 2012, an estimated 193,460 people died from unintentional poisoning worldwide[1], where about 84% of these fatalities occurred in low- and middle-income countries. Deliberate ingestion of pesticides causes 370,000 deaths each year. Despite all-age mortality from unintentional poisoning had reduced to 72,400 in 2017 (95% uncertainty interval 52.7 to 79.4), a –20.8% changes (–28.4 to –12.5) between 2007 and 2017[2]; challenges remain on addressing these preventable deaths by inadequate availability of and access to highly toxic pesticides, clear and uniform policy response is lacking in most countries in the Asia Pacific[3]; and essential life-saving antidotes are not included in National List of Essential Medicines.[4] Access to antidotes was further complicated by challenges in procurement and supply management to maintain minimum stock of antidotes for immediate life-saving interventions.

Snake envenoming is a major health issue affecting remote and rural regions of the tropics.[5] It causes considerable morbidity and mortality worldwide. The highest burden exists in South Asia, Southeast Asia, and sub-Saharan Africa.[6] The need to improve access to antivenoms is a major challenge in these affected countries including South Asia.[4]

In 2017, after intense advocacy by concerned stakeholders including Médecins Sans Frontières, the Global Snakebite Initiative, Health Action International, and advocacy by more than 20 countries, WHO listed snakebite envenoming a priority neglected tropical disease.[7] This was followed by a resolution on the burden of snakebite envenoming adopted in the World Health Assembly in 2018.[8]

Antidotes, antitoxins and antivenom: challenges of availability and accessibility

Given the economic burden and death tolls[9] and global commitment towards improved access to antivenom, its critical shortage remains and technology not dissimilar from early vaccines is still used to manufacture antivenom. This questions quality and safety of these antivenoms.[10,11] There has been

little incentive for innovation or investment in new production technology of antivenom due to lack of purchasing power in low income countries.[9]

"With nearly 46,000 deaths a year, India's antivenom problems center around quality. Four antivenom manufacturers produce upwards of 1.5 million vials a year, but the collection and processing of venoms – used in the making of antivenom – lacks standards and quality control".[12]

Treatment of life-threatening poisoning includes supportive care and specific treatment. For certain poisoning, antidotes are the only choice. They reduce mortality rate, minimize disability, shorten clinical course or minimize the total expenditure of treatment.

Shortage of antidotes is a global challenge, where low and middle-income countries suffer most. An availability survey of antidotes, antitoxin and antivenom in New Zealand hospitals in 2014 showed that, only N-acetylcysteine and octreotide held in adequate quantities by all hospitals to manage a single patient for 24 hours.[13] The average replacement cost for expiring drugs was 171,024 USD, where smaller and isolated facilities face the greatest expense and difficulty in achieving timely resupply. However, another study from New Zealand reports that antidotes are adequately available.[14] Similar situation was reported by Thailand.[15] Pharmaceutical company has no incentive to produce antidote due to the lack of a profitable market.[16]

Despite the 15 essential antidotes proposed in the 2017 WHO Model Essential Medicine List[17], there is no assurance that these antidotes are made available at health facilities throughout the countries in particular in remote and hard-to-reach areas.

Solutions to availability: Thailand's National Antidote Program

The shortage of certain antidotes hampering treatment outcome brought several agencies to establish National Antidote Program in 2011 to ensure nationwide availability and immediate access to antidotes, antitoxins and antivenom. A common essential list of antidotes with difficulties of sourcing was developed, for which domestic production and global search of reliable suppliers and procurement are conducted. A national and sub-national stockpiling of different products is guided by epidemiologic profile, incidence and cost of products. Ensuring access is supported by web-based real time search and request by hospitals having index cases. A 24-hour phone consultation is offered for proper clinical diagnosis, management and monitoring. All these functions are coordinated by Poison Centers[15] The Program is supported financially by National Health Security Office, while the Government Pharmaceutical Organization is responsible for procurement of antidote and antivenom. Multi-agency collaboration ensures long term sustainability.

Since the launch of the Program in 2011, no shortage was reported. There are 16 antidotes including antivenom, all of which have sourcing challenges. The Program contributed to better clinical outcome of severe cases and cost savings from mismatched overstock and un-used medical products.[15] The program also provides emergency supply to other countries within and outside the Region, such as recent botulism outbreak in Nigeria through the facilitation of WHO Country Office.

Accelerating availability and access in Asia: inter-country collaboration

The Program has extended its support to Member States of the WHO South East Asia region where common priority list is agreed upon. Countries can benefit, on a voluntary basis, from two components of the Program: emergency supply of antidotes and payment based on cost, and collective bargaining of price and quantity while countries are responsible to procure based on their procurement rules and regulations. In 2019, with the initiation by the Minister of Public Health, Thailand, the Program is in the process of exploring an opportunity to extend collaboration with ASEAN member states, on a voluntary basis to improve availability and access; so that people in ASEAN can benefit from the collaboration and improve access to these medical products; in an ASEAN spirit of caring and sharing.[18]

Challenges beyond improved availability

Availability alone is not sufficed; affordable, quality products, training of health workforce for diagnosis and clinical management are equally important[9]. Government should strengthen primary health care capacity to prevent, diagnose, treat and refer to hospitals; improve surveillance and reporting[19]; and optimize stockpiling based on a formal antidote hazard vulnerability assessment.[20] Although the opportunities exist as ending Neglected Tropical Diseases was committed by SDG3.3 which includes snake bites as discussed by Ravikar et al[21], there are more aforementioned challenges to be overcome the ambitious goals of ending deaths from snake bites in South Asia and ASEAN.

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Field Evaluation of Malaria Surveillance System in Sai Yok District, Kanchanaburi Province, Thailand

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Abstract

Evaluation of the malaria surveillance system was conducted in Sai Yok District, Kanchanaburi Province, Thailand. The objective of the study was to describe the surveillance system and assess the system performance in reporting malaria cases. The study applied cross-sectional approach. Key qualitative and quantitative attributes were assessed. Document review on malaria cases treated in Sai Yok Hospital and data collection at Vector Borne Disease Control Unit (VBDU) in 2015 were performed. In-depth interviews with policy makers and health care workers were exercised. Findings showed that sustainability of the surveillance system might be undermined if the Global Fund support would curtail after 2017. There were some discrepancies between number of cases reported by VBDU and those by health facility via the R506 national reporting system. Sensitivity of VBDU reports was slightly higher than the reports by the hospital though the overall sensitivity of the whole district was of acceptable quality. Concerning policy recommendations, a substantial shift of budgetary support from the Global Fund to domestic resources was suggested. Health personnel at the hospital should be more emphasized on the utilization of R506 reporting system. In addition, the R506 reporting system and the VBDU system should be harmonized.

Keywords: malaria, surveillance evaluation, Global Fund, human resources

Introduction

Malaria has been one of the most critical global health problems for years. In 2014, approximately 3.2 billion people were at risk of malaria with 214 million reported cases and 438,000 deaths.[1] In Thailand, there were 32,953 malaria cases with 38 deaths in the same year.[2] The Thai Ministry of Public Health

(MOPH) has introduced a number of initiatives with an aim to halt the progress of malaria infection. One of the most renowned campaigns is 'Malaria Free Thailand by 2024'[3].

Surveillance system is an integral component of infectious disease control. It is clearly presented as one of the main four strategies for malaria elimination program in Thailand[3]. A sound surveillance system should contain reliable and timely dataset that provides epidemiologists and health practitioners a clear insight on the situation in the field[4].

The surveillance system for malaria in Thailand consists of passive case detection and active case detection.[3] Passive case detection mainly functions via the routine national infectious diseases case report, namely 'R506', which has been implemented by the Bureau of Epidemiology (BOE), Department of Disease Control, MOPH. The R506 was introduced in public health facilities.

Active case detection is functioned by the Bureau of Vector Borne Diseases (BVBD) under the Department of Disease Control, and in the upcountry, is performed by the Vector Borne Disease Control Unit (VBDU) under the Office of Disease Prevention and Control. Key sub-activities of the active case detection include: (i) special case finding, (ii) mobile malaria clinic, (iii) mass blood survey, and (iv) case investigation during the survey. The active case finding focuses on 10 border provinces, which are at high risk of malaria spreading.[5]

In addition, MOPH has extended its collaboration on malaria eradiation with the external partners. For domestic collaboration, it has been working closely with Biomedical and Public Health Informatics (BIOPHICS) under the Mahidol University, in establishing a web-based surveillance system, so-called, 'Malaria Online'[6]. The web-based system applied the same case definition and classification as the R506 reporting system. The difference is that Malaria Online encompasses both active and passive case detection with a purpose to obtain timely malaria surveillance data and ultimately to feed those data back for implementation of malaria elimination program[5].

In terms of international collaboration, the most distinct supporting agency is the Global Fund (GF) to Fight AIDS, Tuberculosis and Malaria. Founded in 2002, it is the largest international funding instrument to support prevention and treatment of human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS), tuberculosis and malaria in many developing countries with high disease burdens amidst limited capacities to address them, including Thailand.[7]

Despite several initiatives introduced to eliminate malaria, a systemic evaluation of the surveillance system was still lacking. Therefore, the objective of this study was to evaluate malaria surveillance system in Thailand using Sai Yok, a border district between Thailand and Myanmar in Kanchanaburi Province, as a case study.

Methods

Study Design

A cross-sectional approach was applied. Both qualitative and quantitative methods were employed.

Study Site

The study was conducted during 2015 in Sai Yok District, including four subdistricts that are covered by VBDU. Sai Yok District was amongst areas with the highest malaria incidence along the Thai-Myanmar border. To be more specific, Sai Yok Hospital was selected as the main study site.

Data Collection Techniques and Participants

In-depth interviews with 27 key informants were performed, including six policy makers, 18 health workers and three information and technology (IT) staff. Narrative analysis was exercised on qualitative attributes. The R506, VBDU reports, laboratory log-books and medical records in all related health facilities were reviewed in order to address quantitative attributes. Descriptive statistics were applied on quantitative data.

Attributes to be Measured

The analysis started with a system description, followed by a scrutiny in each attribute. Qualitative interview data were used to describe the system and address the following attributes: 'public health importance', 'usefulness' and 'stability'. The key informants were asked whether and to what extent they were aware of the surveillance system, including case definition and data flow. The quantitative data captured different aspects of the system, that is, 'sensitivity' (proportion of cases reported to the system to all malaria diagnosed cases), 'positive predictive value' (PPV) (proportion of malaria-diagnosed cases to all reported cases), 'timeliness' of reporting cases (as measured by difference between diagnosis date and data-submitting date, which should not exceed five days until the data reached the

BOE), and 'completeness' (as measured by the completion of key variables entered in the system)[8].

Results

System Description

The flow of data started when the patients visited malaria post (MP), border malaria post (BMP), malaria clinic (MC), and Sai Yok Hospital. The patients were confirmed by either thick film microscopic exam or rapid diagnosis test (RDT). Both negative and positive cases were recorded in a form, called EP1. If the patient's test found positive, more information would be further collected in another form, namely EP3, which included additional variables, such as risk factors and signs and symptoms. The MP, BMP and MC reported VBDU with EP1 and EP3 forms. VBDU reported the same information in paper to Vector Borne Disease Control Centre (VBDC), and then submitted these data to the Office of Disease Prevention and Control Region 5.

In Sai Yok Hospital, the providers directly entered the data into the R506 system, which was further incorporated into Malaria Online. The frequency of data submission from Sai Yok Hospital to Provincial Health Office which then submitted to BOE, and from BOE to Malaria Online took around a week on average. Apart from the formal communication, there was an informal communicating mean between Sai Yok Hospital and VBDU through a weekly telephone call (Figure 1).

Qualitative Attributes

Public health importance

The majority of interviewees underpinned that malaria surveillance system was of critical importance for malaria control in the whole country. Two thirds of the interviewees flagged that the purposes and objectives of the system were to detect the outbreak, and make the providers understand the trend and situation of malaria. The informants also articulated that they understood and recalled the definition of malaria suspected and malaria confirmed cases very well.

"In my opinion, the malaria surveillance system provides information for malaria situation and timely control when there is an outbreak." – One of health worker interviewees

"Malaria confirmed case is a case that shows positive with lab results" – One of health worker interviewees

Yet, around one third of the interviewees opined that the surveillance for malaria should be given less priority compared to other surveillance systems due to its low prevalence relative to other infectious illnesses. Besides, seven out of eight health workers in Sai Yok Hospital stated that they were not aware of the objectives of the system. Only one interviewee in Sai Yok Hospital who could well describe the purpose of the system was the hospital director.

Usefulness

The usefulness of malaria surveillance program was illustrated in various angles. Of 27 interviewees, 16 mentioned that the surveillance system was beneficial in introducing appropriate control measures. About 11 interviewees highlighted that the surveillance system was helpful in identifying hot spot areas. Around a quarter of the interviewees pointed that the surveillance data were of help in reflecting the providers' performance in malaria control. A few interviewees (~4/27) flagged the value of the system in terms of budget planning and setting research priority.

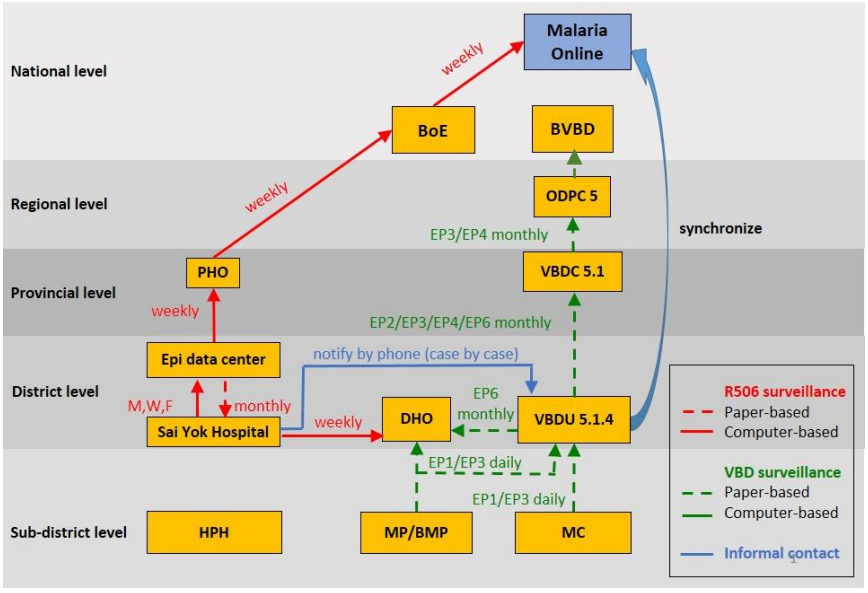

Figure 1. Data flow of malaria surveillance system in Sai Yok District, Kanchanaburi Province, Thailand

Stability

Most health workers raised concern over the stability of the surveillance program. This issue was related to the possibility that GF support would be weaning off. With reference to the 23rd GF Board meeting in 2011, a new eligibility, counterpart financing and prioritization policy was adopted for all funding channels, by taking into account the country income level, disease burden and recent funding history[9]. The GF policy change affected funding opportunities to Thailand, not only for malaria, but also for HIV/AIDS and tuberculosis. Although the burden was high, with a history of recent funding, Thailand was neither eligible to submit a proposal for General nor Targeted Funding Pool (Table 1).

At present, the GF support was earmarked for material (such as computers and tools used for active case detection) and salary costs for health workers. The extent of salary support varied across authorities. BMP and MP might be affected most if GF sponsorship withdrew. This was because all salary costs for BMP and MP staff were subsidized by GF. The reliance on GF support in PHO, VBDC and VBDU was also observed, yet to a lesser extent[10]. Thus, detection and co-ordination function which was the main responsibility of BMP and MP would be undermined by termination of GF funding more severely than other functions (Table 2).

Quantitative Attributes

Sensitivity

In Sai Yok Hospital, a total of 39 malaria cases were identified and reviewed. Eleven cases were found without notification in R506; thus, these missing reports were not submitted to Malaria Online. In VBDU, total 157 malaria cases met case definition for malaria. Amongst these, one was not notified to Malaria Online. Thus, sensitivity of reporting was 71.8% (28/39) in Sai Yok Hospital and 99.4% (156/157) in VBDU.

After combining two data sources (39 cases and 157 cases) and dropping the duplicated cases, a total of 184 cases were identified. Of these 184 cases, 172 were reported to Malaria Online. Hence, the sensitivity of case reporting to Malaria Online over the whole district was approximately 93.5% (172/184) (Figure 2).

Positive predictive value

PPV of the surveillance system was calculated by reviewing EP1 forms in VBDU and medical records in Sai Yok Hospital. It appeared that all 172 cases presented in Malaria Online had evidence of positive laboratory test, reflecting 100% of PPV.

Completeness

Completeness for date of diagnosis, date of investigation and case classification were reviewed in the data entry system. It revealed that all 172 cases had complete information on these variables. This might be due to the 'Must Enter' function in the software which did not allow data submission if these variables were missing.

Timeliness

The R506 system was evaluated for timeliness by measuring lag time between dates of diagnosis and data submission to higher-level health facilities. The median lag time in Sai Yok Hospital was two days (range 0-18 days). The lag time in VBDU was also the same, yet with a much narrower range (median 2 days, range 0-4 days). This corresponded to the fact that about 73% of data from Sai Yok Hospital were submitted to BOE in the recommended period while VBDU demonstrated 100% of timely submission.

Table 1. Profiles of eligibility to the Global Fund support in Thailand

	HIV/AIDS	Tuberculosis	Malaria
Eligibility Criteria			
Income category	UMI	UMI	UMI
Is the country on the OECD-DAC list of ODA recipients?	Yes	NA	NA
What is the disease burden of the country for each component?	High	Severe	Severe
Does the country have a history of recent funding?	Yes	Yes	Yes
General Funding			
Is the country eligible to submit a proposal in the General Funding Pool?	No	No	No
Partial prioritization score (income level and disease burden, the minimum partial score is 3 and the maximum is 12)	NA	7	7
Targeted Funding Pool			
Is the country eligible to submit a proposal in the Targeted Funding pool?	No	No	No

Source: GF Eligibility List (2013)

Acronyms: OECD-DAC = Organisation for Economic Co-operation and Development-Development Assistance Committee, ODA = Official Development Assistance, UMI = Upper middle income, NA = Not applicable

Table 2. Summary of functions related to malaria surveillance in each organization and the extent of salary support by the Global Fund

Organization	Detection	Response	Co-ordination	Salary supported by the Global Fund
BVBD	Not involved	Data management and logistic support	Coordinate with BIOPHICS in data integration*	None
BOE	Not involved	R506 data management	Coordinate with PHO and ODPC for data collection and distribution*	None
ODPC	Not involved	Logistic support*	Coordinate with VBDC	None
PHO	Not involved	Evaluate malaria situation and logistic support	Receive R506 report from hospitals and submit these data to BOE*	About a quarter of staff (1/4) involved in malaria surveillance
VBDC	Not involved	Surveillance on malaria vectors and chemical resistance	Submit data (EP3 and EP4) of malaria cases to ODPC on a monthly basis*	About 11.2% of staff (11/98) involved in malaria surveillance
VBDU	Case investigation	Mosquito spraying	Submit data (EP2, EP3, EP4 and EP6) of malaria cases to VBDC and receive malaria data from BMP, MP and hospitals*	About a quarter of staff (2/8) involved in malaria surveillance
MC	Screen patients with suspected symptoms and perform blood test for malaria*	Provide treatment and follow cases	Submit data (EP1 and EP3) of malaria cases to VBDU on a daily basis	None
Hospital	Screen patients with suspected symptoms and perform blood test for malaria	Provide treatment and follow cases	Collaborate with VBDU for information sharing and dead case investigation*	None
MP and BMP	Screen patients with suspected symptoms and perform blood test for malaria (with test kit)*	Provide basic treatment and refer patients to higher level health facilities	Submit data of malaria cases (EP1 and EP3) to VBDU and District Health Office (DHO)	All staff (5/5) in MP and BMP had their salary supported by GF.
Health center	Screen patients with suspected symptoms and refer them to receive treatment at higher level facilities*	Not involved	Not involved	None
Private clinic	Screen patients with suspected symptoms and refer them to receive treatment at higher level facilities*	Not involved	Not involved	None
BIOPHICS	Not involved	Not involved	Merge and analyse data from BVDB and BOE, then present the data on the webpage*	None
DHO	Not involved	Not involved	Train health volunteers and support the function of MP and BMP*	None

*Note: *Main function*

Acronyms: BVBD = Bureau of Vector Borne Diseases, BOE = Bureau of Epidemiology, ODPC = Office of Disease Prevention and Control, PHO = Public Health Office, VBDC = Vector Borne Disease Control Center, VBDU = Vector Borne Disease Control Unit, MC = Malaria clinic, MP = Malaria post, BMP = Border malaria post, DHO = District Health Office

Discussion

Overall, this study was amongst the first few studies in Southeast Asia that focused on malaria surveillance. Actually, in the sphere of international literature, there were some studies on malaria surveillance evaluation. However, most of which were conducted outside Southeast Asia, like Chehab et al from Qatar[11] and Ibrahim et al from Nigeria[12]. In addition, the study by Chehab et al limited the evaluation only on quantitative attributes whereas qualitative attributes were still missing[11].

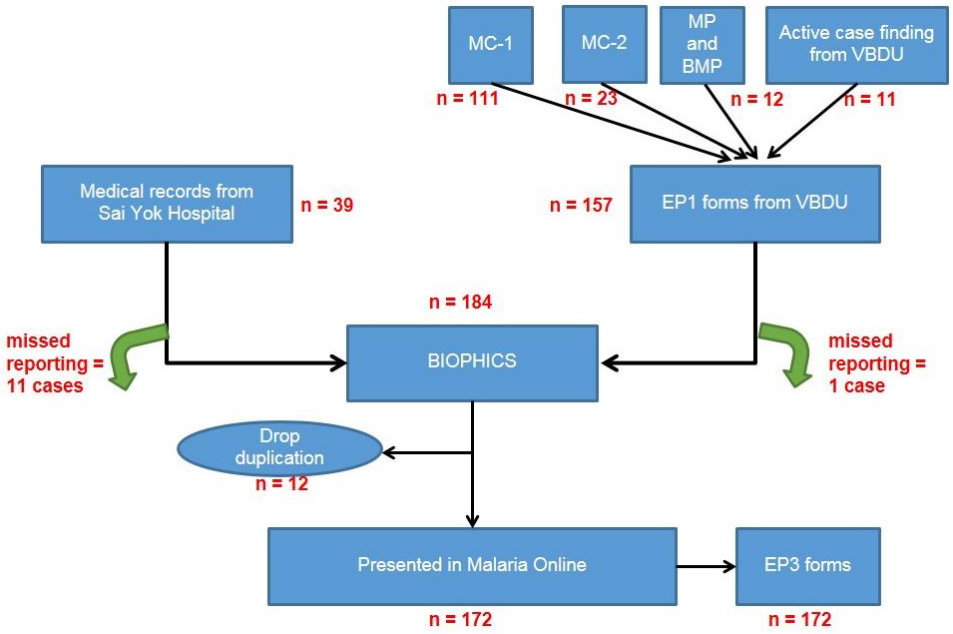

Figure 2. Sensitivity of malaria surveillance system in Sai Yok District, Kanchanaburi Province, Thailand, 2015

One of the few studies on malaria evaluation in Southeast Asia was a research by Rae et al from Myanmar. However, Rae et al paid much attention on the process of diagnosis and treatment over the surveillance system per se[13]. Therefore, this study was probably the first study in Southeast Asia that delved into both qualitative and quantitative attributes of the malaria surveillance system. Sai Yok District was used as a case study for evaluation.

It was found that the system involved a vast range of stakeholders, from frontline health posts (for example, MC, MP and BMP) to well-established health facilities (like Sai Yok Hospital, VBDU and VBDC). There were two strands of data flow: first from VBDU which receives data from MC, MP and BMP, and second from Sai Yok Hospital.

Some discrepancies between these two strands were noticed. The data flow in the VBDU strand was still in a paper-based form (though these data would be keyed into Malaria Online later) while that in Sai Yok Hospital was in electronic form. Though, at the time of study, the sensitivity and timeliness of data reporting in the VBDU strand was still acceptable (99.4% sensitivity with 2-day lag time), a heavy reliance on the paper-based reporting system might pose a risk of reporting delay and data loss. Thus, data flow from both strands should be harmonized.

High sensitivity and timeliness of the surveillance system in VBDU could be explained by the fact that the main responsibility of VBDU and its affiliated health posts was to provide timely case detection. This was evidenced by the observation that almost all health workers working there were quite aware of this responsibility. Besides, the functions in VBDU encompassed various components, including diagnosis, treatment and reporting like a one-stop service unit. By contrast, the main function of Sai Yok Hospital was to provide appropriate treatment rather than perform active case finding. Accordingly, reporting data to R506 was done in a passive manner. This idea coincided with the field observation which demonstrated that most health workers in the hospital did not show a clear understanding of the purpose and objectives of the surveillance system. This factor might help explain lower sensitivity of malaria report in Sai Yok Hospital relative to that of VBDU. Nevertheless, from a macro-perspective, the quantitative attributes of the surveillance system over the whole district (sensitivity, PPV, timeliness and completeness) were of acceptable quality.

Another worth-discussing point was while the interviewees mentioned the usefulness of the system in diverse angles, most of them conspicuously raised concerned over the system stability. This issue was directly linked with the tendency that GF support might be curbed. Similar story was flagged in a study by Patcharanarumol et al, underlining that the curtailment of GF sponsorship might undermine HIV/AIDS prevention programs in Thailand, especially for the prevention programs exercised by civic groups and non-government organizations[7]. Patcharanarumol et al also proposed a pooled funding mechanism that mobilized budget mainly from domestic sources[7]. This idea originated from the fact that Thailand has always relied on domestic resources to fight HIV/AIDS for years while in some countries, like Bhutan, this proposal might not be

able to operationalize easily as around 80% of the fund to tackle HIV/AIDS and malaria were from international donors[14]. The same idea might apply to the case of malaria surveillance as well. Further study on this issue was recommended.

There remained some limitations in this study. First, a case study with single province made it difficult to generalize the findings to other settings[15]. Second, this study did not explore the functions of private health facilities or non-governmental affiliated facilities. Last but not least, the situation of GF support to Thailand (and other countries in the Southeast Asia region) is quite dynamic and at the time of the study, there was a public discussion about whether there were other mechanisms that could secure GF support without breaching the GF eligibility criteria (for instance receiving financial support through a regional proposal)[16]. Therefore, information from the interviews might be obsolete when this article was publicly launched.

Conclusion

This study illuminated the surveillance system for malaria in Sai Yok District. There were two strands of data flow: from VBDU which received data from MC, MP and BMP, and from Sai Yok Hospital. The data flow in the VBDU strand was still in a paper-based form, though these data would be keyed into Malaria Online later. By contrast, Sai Yok Hospital employed electronic data-entering form for the whole system. Both strands were merged together and the final data were presented in Malaria Online. Sensitivity, PPV, timeliness and completeness of the reporting system from both Sai Yok Hospital and VBDU were of acceptable quality. Most participants recognized the usefulness and importance of the surveillance system. However, the main concern was centered on system stability given the withdrawal of GF support. If the GF financial assistance was to curtail, the detection functions performed by MP and BMP would be affected most.

Recommendations for Public Health Actions

Concerning policy recommendations, there should be a substantial shift of budgetary support from GF to domestic resources. Health personnel at the hospital should more emphasize on submission of malaria data to the R506. In addition, the R506 reporting system and the VBDU system should be harmonized.

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Evaluation of the Indonesian Animal Brucellosis Surveillance System in 2016 using the Outild'analyse des systèmes de surveillance (OASIS) Method

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Abstract

Surveillance system evaluation is essential for the system improvement. The Indonesia government is conducting the animal brucellosis surveillance to determine herd prevalence and detect infected animals in the herd. This study was conducted to evaluate this brucellosis surveillance system using the Outild'analyse des systèmes de surveillance (OASIS) tool. The questionnaire, developed based on the OASIS tool, was sent to officers in charge of the surveillance system at national, regional and local levels. After collection of information, a consensus panel meeting was conducted to validate and summarize the responses. The OASIS tool assessed the level of satisfaction, critical points and attributes of the surveillance system. There were 37 respondents, including 27 provincial, eight regional and two national officers. The respondents were most satisfied with the information dissemination component of the system. They were also satisfied with the utility of the system, laboratory capacity, surveillance tool, data analysis and communication. In contrast, attention was needed for field institutional organization, surveillance procedures and evaluation, sampling points, and representativeness. Corrective actions can be taken and prioritized based on the evaluation findings, focusing at specific elements which did not meet the officers' expectation.

Keywords: brucellosis, OASIS, surveillance evaluation, Indonesia

Introduction

Animal health surveillance system, which consists of activities that generate information on health or disease status in animal population, is essential for providing evidences of disease absence or describing the occurrence of a particular disease.[1,2] Surveillance system evaluation is also crucial to ensure appropriate resource allocation, providing meaningful information and improvement of surveillance component that are deficient.[3,4] A surveillance system can be evaluated using a qualitative, semi-quantitative or quantitative approach.[5]

The Outild'analyse des systèmes de surveillance (OASIS) method[6] is a semi-quantitative approach

used in animal diseases surveillance evaluation. The tool assesses the characteristics of 10 components in the surveillance system: objective, central organizational aspects, field institutional aspects, laboratories, surveillance tools, surveillance procedures, data management, training, communication and evaluation. The tool consists of scoring criteria and supplementary materials such as a questionnaire and scoring guidance.[7,8] The tool analyzes information in the questionnaire and provides three different outputs: surveillance system component, critical points and attributes.

Brucellosis adversely affects to small-scale cattle farm in Indonesia. Different levels of prevalence were identified in 20 out of 34 provinces. The Indonesia government implemented surveillance to determine brucellosis prevalence at farm level and detect infected animals in the farm.[9] The government at the national (Directorate of Animal Health, DAH), regional (Disease Investigation Center, DIC) and local (Provincial and District Veterinary Services) levels had responsibilities for specific activities.

Regional and local levels were responsible for conducting active and passive surveillance by reporting brucellosis syndromes such as abortion in the third trimester of pregnancy or swollen joints in cattle, and collecting blood samples for laboratory confirmation. The active surveillance had been conducted by sample collection in cattle farms. DAH was responsible for developing policies, guidelines, and managing the surveillance system. Monitoring for disease signs and syndromes, data reporting and laboratory testing were the main activities of the surveillance. Surveillance data were managed in two databases, the Integrated National Animal Health Information System (iSIKHNAS) which managed syndromic surveillance data, and the Laboratory Information System (InfoLAB) which managed laboratory results (Figure 1).

In the past few years, the Indonesia government had promoted cattle raising in small-scale farms to secure meat either supply or self-sufficiency in Indonesia. Brucellosis could be a threat to the success of the program due to chronic production losses of infected animals, in addition to zoonotic potential. Thus, this study was conducted to evaluate the current brucellosis surveillance system by assessing the opinion of stakeholders using the OASIS tool in order to provide recommendations for prevention and control of the disease.

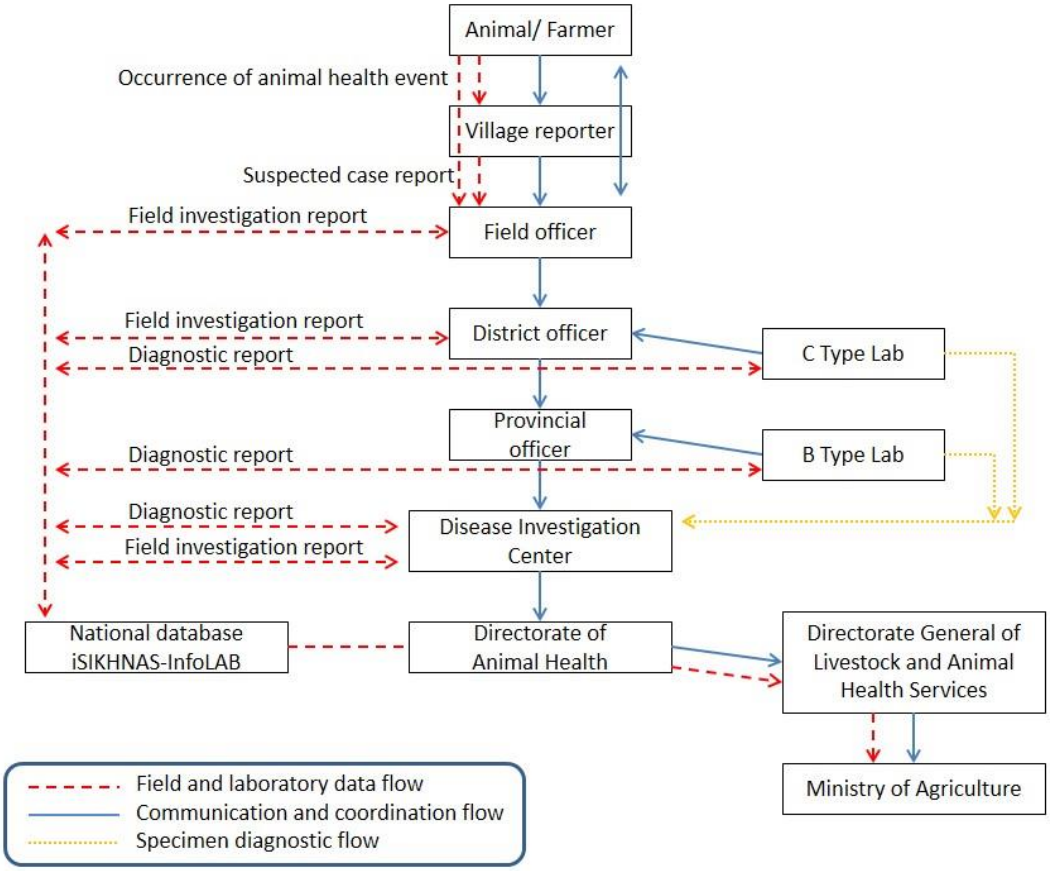


Figure 1. Structure of animal health surveillance system in Indonesia

Methods

Evaluation Process

The study was conducted between September 2015 and February 2016. The evaluation process, from preparation to reporting, involved several officers in charge of the surveillance system at different levels. We reviewed and modified the OASIS tool and questionnaire for brucellosis according to different (provincial, regional and national) levels of the government staff. We followed the OASIS tool to group surveillance components for evaluation into 10 components, comprising objective, central organizational aspects, field institutional aspects, laboratories, surveillance tools, surveillance procedures, data management, training, communication and evaluation. Total 78 criteria included in evaluation of each component (Table 1). The questionnaire was pre-tested with national and regional staff before deploying.

Table 1. Criteria for scoring of each component of the animal brucellosis surveillance system in Indonesia

Surveillance component	Scoring criteria
1: Objectives and context of surveillance	1) Relevance of surveillance objectives, 2) Level of detail, accuracy and formalization of objectives, 3) Taking partners' expectations into account, 4) Coherence of the diseases under surveillance with the sanitary situation (existing/exotic diseases or threats)
2: central organizational	1) Existence of an operational management structure (central unit), 2) Existence of an operational steering structure that is representative of the partners (steering committee), 3) Existence of a scientific and technical committee for the system, 4) Organization and operations of the system laid down in regulations, a charter, or a convention established between the partners, 5) Frequency of meetings of the central coordinating body, 6) Supervision of intermediary units by the central level, 7) Adequacy of the central level's material and financial resources
3: Field institutional organization	1) Existence of formal intermediary units covering the entire territory, 2) Active role of intermediary units in the functioning of the system (validation, management, feedback), 3) Implementation of supervision by the intermediary level, 4) Harmonization of intermediary units' activities, 5) Adequacy of material and financial resources of intermediary units, 6) Existence of coordination meetings at the intermediate level, 7) Exhaustiveness or representativeness of the field agents' coverage of the target population, 8) Adequacy of material and financial resources at the field level
4: Laboratory	1) Effective integration of laboratories in the surveillance system, 2) Adequacy of human, material, and financial resources for diagnostic needs, 3) Application of Quality Assurance for the tests undertaken, 4) Quality of the standardization of work between different laboratories, 5) Proportion of tests submitted to inter-laboratory trials, 6) Existence of an investigation team to support field agents, 7) Relevance of diagnostic techniques, 8) Sensitivity of diagnostic techniques, 9) Specificity of diagnostic techniques, 10) Control of laboratory reagents, 11) Technical level of data management at the laboratory, 12) Analysis deadlines at the laboratory (formalization, standardization, verification, transfer of results to the central unit), 13) Quality of results delivered
5: Surveillance tools	1) Existence of a formalized surveillance protocol for each disease or threat under surveillance, 2) Standardization of data collected, 3) Relevance of measurement tools (excluding laboratory tools), 4) Sensitivity of the case or threat definition, 5) Specificity of the case or threat definition, 6) Simplicity of the case or threat definition, 7) Quality of the filling out of investigation forms, 8) Relevance of collected samples, 9) Standardization of collected samples, 10) Quality of samples collected, 11) Respect of the interval between the detection of a case or threat and the delivery of results, 12) Simplicity of the notification procedure, 13) Simplicity of the data collection procedure, 14) Acceptability of the consequences of a suspicion or case for the source or collector of data
6: Surveillance procedures	1) Appropriateness of surveillance procedures with the system's objectives, 2) Existence of passive (event-based) surveillance whose results are exhaustive or representative, 3) Existence of awareness building programs for data sources in a passive (event-based) network, 4) Relevance and suitability of active (planned) surveillance protocols, 5) Surveillance of susceptible wild animals, 6) Vector surveillance and control, 7) Representativeness of the populations targeted by sampling in active (planned) surveillance, 8) Precision of sample under active (planned) surveillance, 9) Level of satisfaction of active (planned) surveillance completeness rate
7: Data management	1) Adequacy of the data management system for the needs of the system (relational database, etc.), 2) Data input interval in accordance with the objectives and use of system results, 3) Designated staff available and trained in data entry, management and analysis, 4) Adequacy of material and financial resources for data management and analysis, 5) Data verification and validation procedures formalized and operational, 6) Complete descriptive processing of data, 7) Exploitation of data fits the needs of the system (if possible regular and multi-disciplinary)
8: Training	1) Adequate skill level in epidemiology of members of the central unit, 2) Initial training implemented for all field agents when joining the system, 3) Objectives and contents of initial training of system field actors adequate for operational surveillance needs, 4) Regular advanced training 5) Adequacy of material and financial resources for training
9: Communication	1) Regular release of reports and scientific articles on surveillance results, 2) Return of individual test results to field actors, 3) Regular dissemination of a relevant information bulletin, 4) Systematic return of reports on results to field actors (outside of a bulletin), 5) Presence of a communications system organized transversally and vertically between field actors (mail, web, telephone), 6) Solid external communication policy, 7) Adequacy of material and financial resources for communication
10: Evaluation	1) System of performance indicators developed and validated by the directors of the network, 2) Performance indicators regularly measured, interpreted, and disseminated, 3) External evaluations carried out, 4) Implementation of corrective measures

Evaluation involved officers in-charge of the surveillance system at all levels. The questionnaires were sent by email to officers, including one officer each from 34 provinces and eight DICs, and two officers from national surveillance section (Table 2).

The Scoring Criteria

The OASIS scoring guideline was used to evaluate 78 criteria. The scores ranged 0-3 (with description guideline), reflecting the level of compliance of the component under examination. If the specified criterion was not relevant for the system, it would be classified as "not applicable" (NA) without any scoring and not considered in the analysis. The respondents could also provide additional comments, explaining their reasons for the particular scoring. An example of one of the scoring criteria for surveillance procedures is illustrated in table 3.

Finalizing the Scores

All data and information were reviewed and validated. A panel of respondents (2 from national, 8 from regional and 2 from provincial) met to produce a summary of satisfactory levels of each criterion, finalized the scores and provided their justification. The satisfactory level was automatically created and generated by the OASIS tool using a specific combination of the scoring criteria. The OASIS tool generated three outputs of the evaluation: 10 components (as described above), seven critical points (Objectives, coordination, surveillance tool, sampling, data collection, data analysis and information dissemination), and 10 attributes of the surveillance system (utility, flexibility, acceptability, simplicity, reliability, stability, representativeness, sensitivity, specificity, and timeliness).

Table 2. Summary of the animal brucellosis surveillance system evaluation process in Indonesia

Pre-action	
1. Desk review	Reviewing OASIS tool to be fit in Indonesia context
2. Tool pre-test	- Assigning 1 national officer and 2 regional officers to finalize OASIS tool - Selecting the questions from OASIS questionnaire according to its level (national, regional, local)
3. Respondent selection	Selecting person in-charge on surveillance system in national (2 persons), regional (8 persons), provincial (34 persons) levels
Action	
4. Send the questionnaire	Sending the questionnaires (with selected questions according to its level), by email to selected respondents
5. Complete the questionnaire	- Each question was scored by respondents: 0-3 or not applicable, according to the degree of adequacy and made additional comments. - Sent a reminder message to respondents
Post-action	
6. Questionnaire compilation	All scores compiled and adapted to the respondents comments and other documents.
7. Rating scoring criteria	- Final score was given based on consensus, put in the scoring tool– and automatically generated 3 outputs (pie chart, histogram, radar chart) - The percentage number in 3 outputs defined in 4 levels of satisfaction: ≥ 90 as highly satisfactory, <90-80 as satisfactory, <80-70 as less satisfactory, and <70 as unsatisfactory.
8. Summarizing	All findings were summarized as a final report.

Table 3. Example of guideline for scoring of one criteria (surveillance procedures: relevance and suitability of active (planned) surveillance protocols) for animal brucellosis surveillance in Indonesia

Component 6: Surveillance procedures	
6.4 Relevance and suitability of active (planned) surveillance protocols To score, choose from the following options:	
Score of 3	The objectives of the system require active surveillance and the active surveillance protocol procedures in place respond perfectly to the objectives.
Score of 2	The objectives of the system require active surveillance but the active surveillance protocols in place need to be modified slightly to better respond to these objectives.
Score of 1	The objectives of the system require active surveillance but some active surveillance procedures needed to respond to these objectives are missing or the procedures in place require important modifications.
Score of 0	No active surveillance protocol is in place although the objectives of the surveillance clearly require an active surveillance protocol.
Not applicable	No active surveillance protocol is in place and the objectives of the surveillance do not require an active surveillance protocol.

The panel categorized the satisfactory level that was generated by OASIS tools into four levels of satisfaction: 90 and above as highly satisfactory, under 90-80 as satisfactory, under 80-70 as less satisfactory, and under 70 as unsatisfactory.

Results

All selected persons in charge for the surveillance system at the national (2 persons) and regional (8 persons) level, and 27 out of 34 provincial staff responded the questionnaire. After reviewing and validating the result of all questionnaires, the levels of satisfaction were summarized by outputs.

Outputs

Output 1: Surveillance system components

From 10 components, three components were rated as satisfactory, including communication 85.7% (18/21), laboratory 84.6% (33/39) and surveillance tool 81.0% (34/42). Four components were rated as less satisfactory, including data management 76.2% (16/21), objectives of surveillance 75.0% (9/12), training 73.3% (11/15) and central institutional organization 71.4% (15/21). Three components were rated as unsatisfactory, including field institutional organization 62.5% (15/24), surveillance procedures 51.9% (14/27) and evaluation 58.3% (7/12) (Figure 2).

Component	Chart	Percent
1. Objectives and context of surveillance		75
2. Central institutional organization		71
3. Field institutional organization		63
4. Laboratory		85
5. Surveillance tools		81
6. Surveillance procedures		52
7. Data management		76
8. Training		73
9. Communication		86
10. Evaluation		58

Figure 2. Satisfaction levels of the structures and procedures of the animal brucellosis surveillance system in Indonesia

Output 2: Surveillance system critical points

Amongst a total of seven critical points, information dissemination (90.0%, 9/10) was rated as highly satisfactory. Surveillance tool (85.0%, 17/20) and data analysis (80.0%, 8/10) were rated as satisfactory. Objectives (73.3%, 11/15), coordination (73.3%, 11/15), and data collection (70.0%, 7/10) were rated as less satisfactory while sampling (60.0%, 12/20) was rated as unsatisfactory (Figure 3).

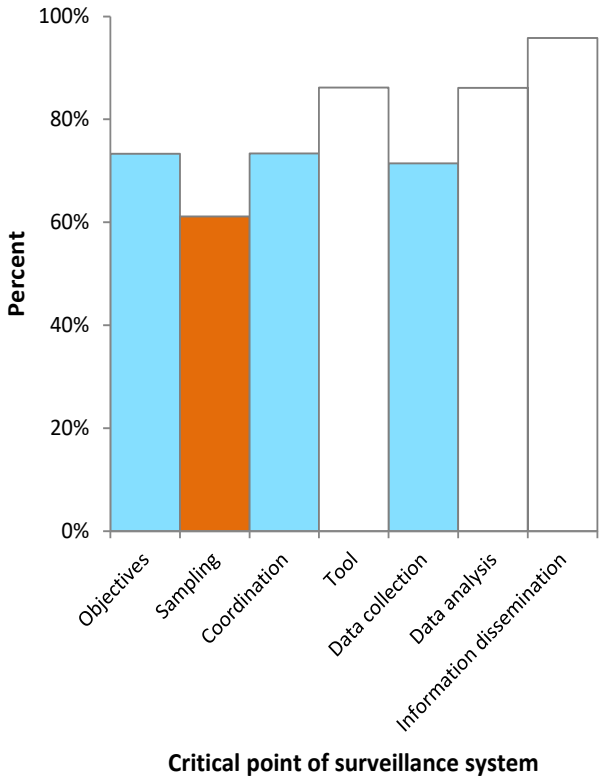


Figure 3. Satisfaction levels of the animal brucellosis surveillance system critical points in Indonesia

Output 3: Surveillance system attributes

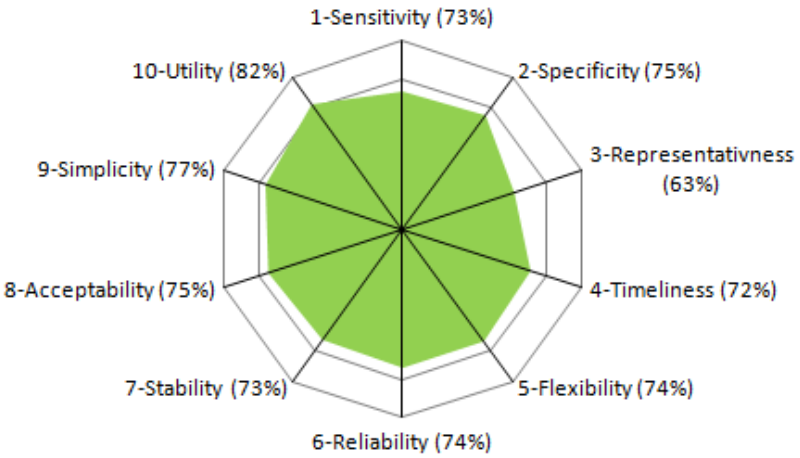
Out of total 10 attributes, utility (82.3%, 79/96) was rated as satisfactory. Eight attributes were rated as less satisfactory, including simplicity 76.7% (46/60), specificity 75.0% (27/36), acceptability 75.2% (115/153), flexibility 73.6% (64/87), reliability 73.7% (294/399), stability 72.6% (135/186), sensitivity 73.3% (121/165) and timeliness 71.6% (58/81) while representativeness (62.5%, 30/48) was rated as unsatisfactory (Figure 4).

Strengths of the Brucellosis Surveillance System

Organizational structure

There were effective functional scientific and technical committees for brucellosis at all levels.

Formal intermediary units (Provincial and district levels) existed with their active roles covering the entire country.



Note: outer and inner lines represent 100% and 80% respectively.

Figure 4. Satisfaction levels of different attributes of animal brucellosis surveillance system in Indonesia

Number of staff at the national level were competent in epidemiology with, at the minimum, a master level in epidemiology or over five years of professional experience in field epidemiology.

Surveillance protocol

The protocol to address the objectives of the brucellosis surveillance system, which required active surveillance, had been in place.

The case definition was simple and sensitive for detection of brucellosis and to guarantee that all manifestations of brucellosis would be picked up.

Sample collection and diagnosis

The collected samples were suitable for testing upon arrival at the diagnostic laboratory.

Laboratories had a clear position in the system that provided the staff significant roles in operation and organization of epidemiological surveillance.

The diagnostic method had a high sensitivity with regular inter-laboratory trials.

Information dissemination

The maximum interval between analysis of samples and transfer of laboratory results to the central unit was defined and verified using the computerized information management system at the laboratory (InfoLAB).

A database existed at the national level (iSIKHNAS), integrating all of the data of the surveillance system, and it was compatible with the size of the surveillance system.

Reports and scientific articles of brucellosis were released regularly. The communication system was used effectively by the large majority of the surveillance stakeholders.

Challenges Identified

Limited resources and workload

At the national level, there was insufficient operational management such as data management, processing, interpretation and validation of iSIKHNAS due to limited number of staff, workload on administrative tasks and maintenance activities.

At the regional level, there was over-workload, delay of diagnosis and materials procurement to perform laboratory diagnosis.

At the local level, limited availability of financial resources and workload to implement iSIKHNAS were the main challenges.

Representativeness

Due to wide geographical area of Indonesia, the submitted samples in active surveillance system did not cover appropriate target population, leading to lack of representativeness of the surveillance result.

Results from the syndromic surveillance were not reported consistently by local officers.

Surveillance protocol and data collection

Changing of the active surveillance protocol caused confusion of local staff.

Data collection form and instruction were not well standardized and not consistently used by local staff.

Utilization of information

The system needed to regularly explore surveillance data and include a multi-disciplinary team due to zoonosis potential.

Discussion

The laboratory was one of the strongest components in the surveillance system. There were well-qualified laboratory personnel who were essential for the surveillance system. The laboratory staff need to understand the limitations and applicability of diagnostic tests[10]. DICs were the main unit responsible for animal laboratory tasks in Indonesia. However, their workload could be overwhelmed by other responsibilities, including conducting disease investigation. The variety of active surveillance protocols needed to be standardized. Frequent changes of the protocols could lead to non-compliance. The communication was the strength of the system since regular reports were produced to engage users in this study. The comprehensive report could improve the acceptability, representativeness, quality and usefulness of the surveillance to stakeholders[11].

System utility was perceived to be satisfactory at all administrative levels. It reflected contribution of the system to improve understanding of the disease distribution[12], prevention and control[2]. The system equipped with a relational database (iSIKHNAS) that provided latest information for stakeholders to understand current disease distribution. The system could be improved by conducting data exploration using a multi-disciplinary approach. In addition, iSIKHNAS had been developed as real-time syndromic surveillance database. It was designed as all data were stored and managed primarily at a central location and integrated within the same framework[10]. The reporting of brucellosis syndrome tended to be under representative. The possible reason was that iSIKHNAS reporters had to be familiar with the procedures to use mobile phone for reporting with standardized codes. To address this constraint, training could be targeted at different audiences to improve users' knowledge and awareness, and also to emphasize the reporting procedures.

There were challenges identified in this study. At the national level, composition of staff and time allocation to manage the system were inadequate. DAH was responsible for the management of brucellosis as well as all other animal diseases at the national level. The workload for their staff was one of the major challenges for the brucellosis control and prevention program. This constraint might also affect the quality of other surveillance components. Similar to the regional and local levels, lack of representativeness of field samples could be due to lack of resources allocated to cover surveillance area. It was in line with AIP-EID[10] findings in inadequate operational budget at field level. The national decentralization policy provided the local administrative level to manage their resources allocation[13,14]. Distribution of responsibilities among stakeholders and program prioritization are the best ways to allocate limited resources and avoid overlapping of roles. Thus, to address this constraint, DAH had to prioritize animal diseases and activities as well as effectively coordinate with the local government.

Salman et al[2] stated that basic requirement of evaluation was to use an objective, transparent and systematic approach. The OASIS tool has been developed to evaluate surveillance systems by providing standardized and clear guidelines. It can be used by external evaluators or through self-assessment. The subjectivity issue by respondents could be reduced through the use of questionnaires to allow probing and confirmation of information, collecting comments associated with each scored criterion and producing of a consensus score for each evaluation criterion amongst actors. The OASIS tool can also be applied to evaluate other animal diseases with some modification to make it suitable for characteristics and objectives of the surveillance system.

The study was the first brucellosis surveillance system evaluation using the OASIS tool that provided a basis for improvement of system. Strengths and constraints were identified for improvement of the system. Involving wider stakeholders (e.g. public health sector, farmer, district office and different levels of animal health laboratory) in future evaluation would facilitate clearer picture of the brucellosis surveillance system. Evaluation measures should be conducted regularly to ensure that the quality and performance of the surveillance system is appropriate for the objectives the system.

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Sequential Clusters of Multidrug-resistant Cholera Cases in the Thai-Myanmar Border, 2015

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Abstract

A drug-resistant cholera outbreak occurred at the Thai-Myanmar border in April to May 2015. On 21 Oct 2015, the Bureau of Epidemiology was notified of a cholera outbreak in Mae Sot District, Tak Province. An investigation was conducted to confirm the outbreak, identify source of infection and provide control measures. Medical records were reviewed and all cases and contacts were interviewed. Active case finding was performed in the affected areas and nearby communities. Rectal swabs were collected and tested for *Vibrio cholerae* O1/O139. Water and food samples were tested for possible contamination. A series of three separate outbreaks of multidrug-resistant *V. cholerae* O1 El Tor Ogawa infection were identified in the same district. The first cluster occurred among Myanmar migrant workers in a garment factory. Poor hygiene was found among workers and food handlers. The second cluster occurred among persons from Myanmar in Mae Sot Subdistrict. The last cluster occurred among Thai while most of them joined a religious ceremony in Mae Pa Subdistrict. The outbreaks were confirmed as *V. cholerae* O1 Eltor Ogawa resistant to ampicillin, co-trimoxazole and tetracycline. Rapid response and improvement in hygiene were recommended.

Keywords: Cholera, outbreak, *Vibrio cholerae*, migrants, Thai-Myanmar border

Introduction

Cholera is an infectious disease caused by some strains of *Vibrio cholerae*.[1] Symptoms can range from none to severe.[2] The most common symptom is large amount of watery diarrhea that lasts for 2-3 days[3] while fever is rare[4]. In case of severe diarrhea, the patient may have severe dehydration and electrolyte imbalance within hours.[3] The incubation period is about two hours to five days.[2]

Cholera is spread mostly by water and food which have been contaminated with human feces.[3] Insufficiently cooked seafood is also a common source.[5] Risk factors for the disease include poor sanitation, lack of clean drinking water and poverty.[3]

Cholera can be diagnosed by a stool test or rectal swab culture.[3,6] Prevention involves improved sanitation and access to clean water.[7] The primary treatment is oral rehydration therapy.[3] In severe cases, intravenous fluid and antibiotics may be beneficial.[2] Antibiotics can shorten the course of the disease and reduce the severity of symptoms.[8]

Between May and October 2007, a cholera outbreak, involving biotype El Tor, serotype Inaba, took place in Mae Sot District.[9] The district shares the border with Myanmar for about 60 km. A large number of population from Myanmar migrated to work in the district due to political instability, widespread poverty and rapid growth of Thai economy in recent

years.[9] Cholera outbreaks sporadically occur in many parts of Thailand, especially in the border areas. Both Inaba and Ogawa serotypes were seen mostly from migrant workers.[10-12]

On 21 Oct 2015, the Bureau of Epidemiology (BOE) was notified by the Office of Disease Prevention and Control (ODPC) 2 of a cholera outbreak in Mae Sot District, Tak Province. The outbreak began among Myanmar workers in a garment factory (Factory X) on 14 Oct 2015 and then spread to nearby communities. The surveillance and rapid response team of BOE, ODPC 2, Tak Provincial Health Office, District Health Office and Mae Sot Hospital conducted an investigation on 22 Oct to 8 Dec 2015 to confirm the diagnosis and outbreak, identify cause and source of infection, and control the outbreak.

Methods

Review of Cholera Situation in Thailand and the Index Event

The event-based database of BOE was reviewed for details of previous outbreaks occurred during 2007 to September 2015. Data from investigations were reported into the database by local officers when case or outbreak occurred. Medical records of the index case at Mae Sot Hospital were also reviewed for clinical course, treatment and laboratory tests, including stool culture.

Active Case Finding

The target population were persons who lived in Mae Sot District during 4 Oct to 8 Dec 2015. We conducted a door-to-door search for cases in the district.

For the case definitions, a suspected case was a person who had at least three times of loose stool or at least one time of watery or bloody mucoid stool per day from 4 Oct to 8 Dec 2015. A confirmed case was a suspected case who was tested positive for *V. cholerae* O1 or O139 in stool or rectal swab by culture. A contact was a person or neighbor who lived or worked together with a confirmed case. An asymptomatic infected person was a person who had no diarrhea, but stool or rectal swab was positive for cholera bacteria. We interviewed all cases and contacts for history of illness and possible source of infection using an investigation form of BOE[13].

Laboratory Study

Rectal swabs were obtained from symptomatic cases, food handlers and contacts in the communities. The specimens were transported in Cary-Blair transport media and sent to Mae Sot Hospital within four hours for bacteriological culture. The results were reported within 24 hours. Drug sensitivity for ampicillin, tetracycline, co-trimoxazole, chloramphenicol and norfloxacin was tested by the standardized disc method[14] if the organism was found. According to the Medical Laboratory Unit in Mae Sot Hospital, drug resistance was defined when the zone of growth inhibition around each of the antibiotic disk was less than 19 mm for ampicillin, less than 15 mm for co-trimoxazole, less than 14 mm for tetracycline, less than 20 mm for chloramphenicol and less than 12 mm for norfloxacin.

All available food specimens in the canteen of Factory X during the field investigation were collected and cultured for possible cholera contamination. Samples of drinking water and water for washing from the cases' residences and the nearby market were collected using purposive sampling, and tested for cholera contamination and chlorine level.

Environmental Observation

We conducted an environmental survey in the affected areas and nearby communities using a walk-through survey method, and recorded in a checklist. We interviewed and observed cases for behaviors such as eating, toilet use and hand washing. We also observed source of drinking water, water for washing, and water privy and bin.

Results

Situation of Cholera in Thailand

There were total 427 outbreaks of cholera, with 1,673 affected individuals had been reported through the event-based database of BOE during 2007 to September 2015. Major outbreaks of cholera mostly occurred among factory workers and migrants along border areas (Figure 1).

Description of Index Case

The index case was a 48-year-old Myanmar female, with no underlying disease. She worked as a seamstress in Factory X, a garment factory in Mae Sot District. There were 296 Myanmar workers sewing in this factory. On 17 Oct 2015, she had watery diarrhea for 4-5 episodes, no fever, mild nausea and vomiting, dehydration and fatigue. She went to Mae Tao Clinic on the same day. Rectal swab culture was not done. She had no history of travel within a month and met no one outside the village. She informed that she had consumed the left-over curry cooked by herself a day before she got sick.

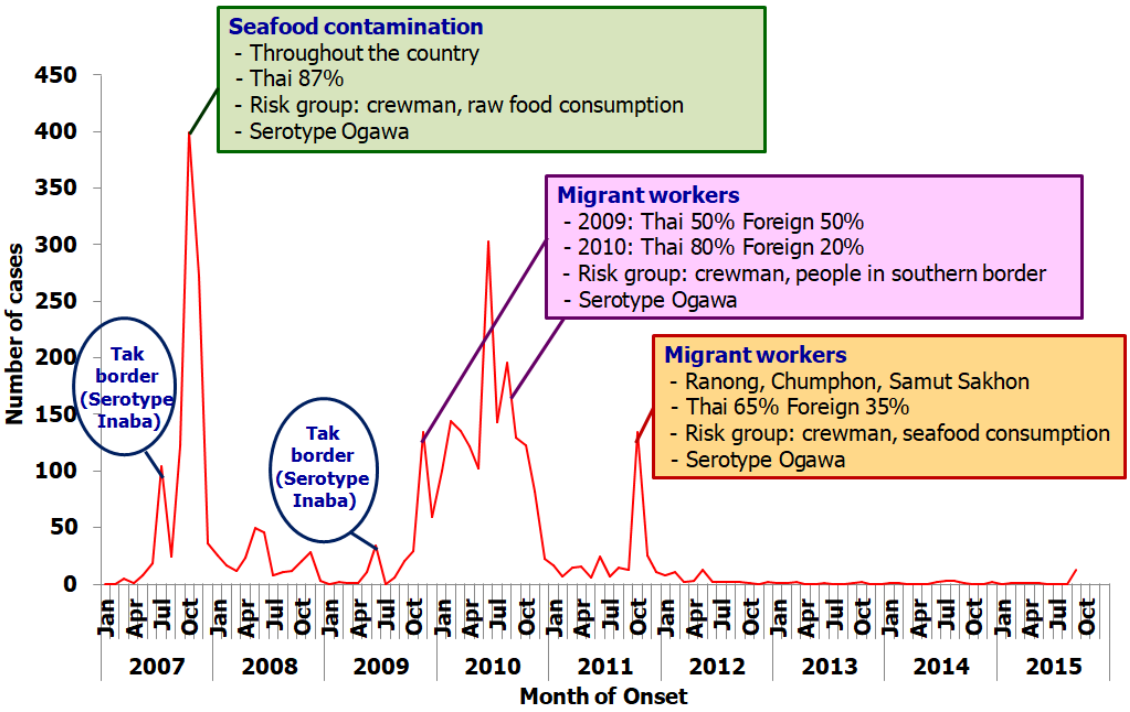

Figure 1. Major outbreaks of Cholera in Thailand. January 2007 - September 2015

Active Case Finding

The outbreak was divided into three clusters (Figures 2 and 3).

First cluster (In Factory X and nearby communities)

The first cluster occurred among Myanmar workers in Factory X, Phra That Pha Deang Subdistrict during 12 to 27 Oct 2015. Totally 220 people were included in the investigation: 209 out of 296 workers, six family members and five food handlers. There were 22 suspected cases (two cases were admitted) and all of them were workers. Total attack rate was 10.5% (22/209). The median age was 22 years (Interquartile range, IQR 9). No one had history of travel within one month. However, one worker informed us that his relatives from Kayin State in Myanmar just came to visit him. There were no symptomatic cases among the people who lived around the factory.

Second cluster (Car service center near Pa Chareon Market)

The second cluster occurred in a car service center near Pa Chareon Market, Mae Sot Subdistrict during 3-9 Nov 2015. There were 45 people in this area. All were also from Myanmar. Three suspected cases were found. No one was admitted. Attack rate was 6.7% (3/45). The first case went to Phra That Pha Deang Subdistrict, where Factory X is located, before the illness. However, the case did not meet anyone in the factory and no solid evidence of linkage between the two clusters could be identified.

Third cluster (In Mae Pa Subdistrict)

The last cluster occurred among people who joined a religious ceremony at Pai Lom Temple, Mae Pa Subdistrict during 13-28 Nov 2015. Eight suspected cases were identified from total 30 people who joined the ceremony and had lunch together at the temple. Attack rate was 26.7% (8/30). No one was admitted. All were Thai. The median age was 50 years (IQR 14). One additional suspected case was found through active case finding in a nearby temple in the same subdistrict. He came from Phitsanulok Province for a seminar. He did not join the religious ceremony in Mae Pa Subdistrict. Other people participated in the same event could not be traced.

Laboratory Study

First cluster

Rectal swabs were collected from 220 people in the factory, including 22 suspected cases, 193 contacts and five food handlers. Twenty out of 22 suspected cases and seven out of 193 contacts were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline) while all 27 with the positive results were workers. Rectal swabs from five food handlers were negative for cholera infection.

Less than 0.2 ppm of residual chlorine was detected from five samples of drinking water and eight samples of washing water from the factory. Ten samples of tap water, pond water and groundwater from community around the factory were tested and revealed no chlorination. No cholera was found from the samples of food and water collected.

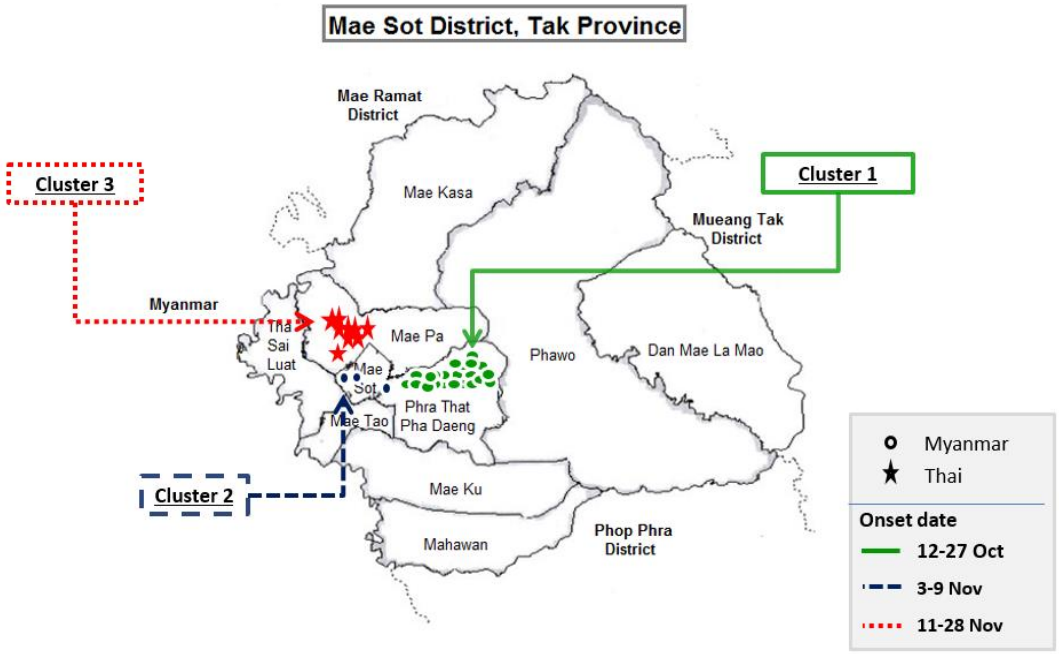

Figure 2. Cholera Cases in Mae Sot District, Tak Province, Thailand, 12 October - 28 November 2015

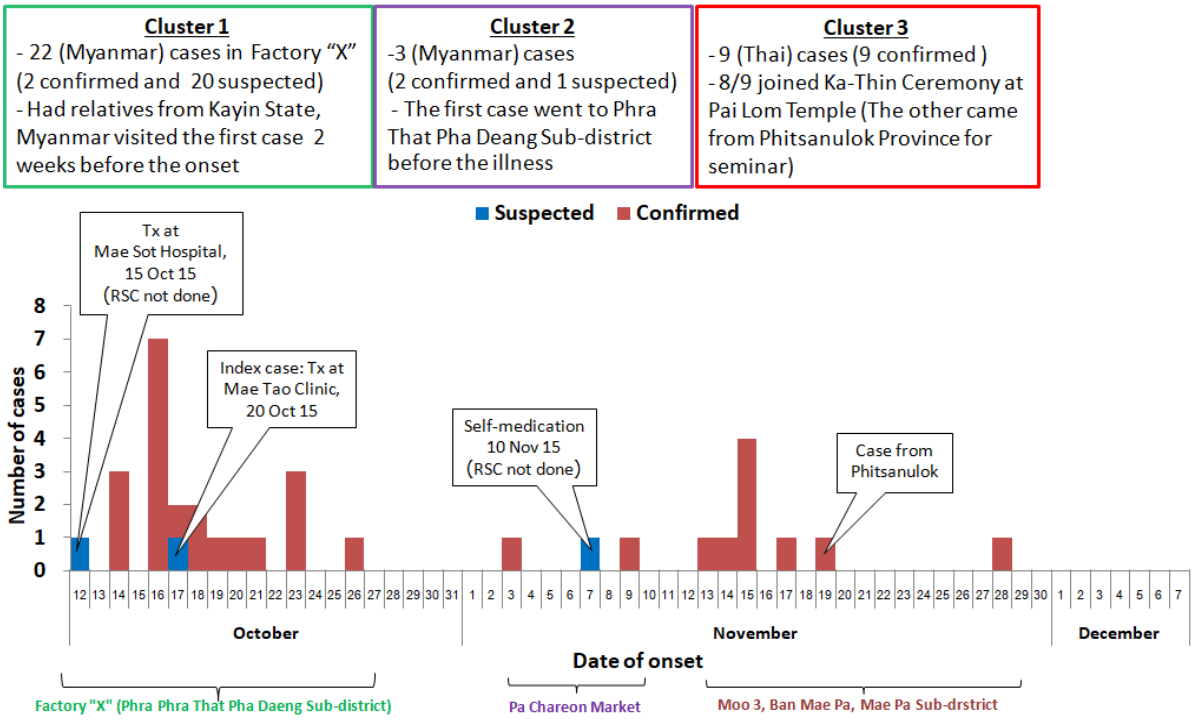

Figure 3. Cholera Cases in Mae Sot District, Tak Province, Thailand, 12 October - 8 December 2015

Second cluster

Rectal swabs were collected from two out of three suspected cases in the car service center. Both were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline). Rectal swabs from 42 contacts were negative for cholera infection.

Food specimens were not available for testing. No residual chlorine was detected from two samples of drinking water and two samples of washing water. No cholera was found in the samples of water collected.

Third cluster

Rectal swabs were collected from 30 persons who attended the ceremony. Nine were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole, and tetracycline).

All rectal swab specimens from 21 contacts were tested negative for cholera infection. However, rectal swab of a suspected case from a nearby temple was positive for *V. cholerae* O1, El Tor Ogawa which was resistant to ampicillin, co-trimoxazole and tetracycline as well.

No left-over food was available for laboratory testing. No chlorination was detected from three samples of tap water in the temple and five samples of washing water. No cholera was found from the samples of water collected.

Environmental Observation

First cluster

Most of the workers consumed food with their hands, shared the spoons and did not wash their hands before eating. They usually ate the left-over food from the previous meals without reheating. Food handlers used bare hands in preparation of food, wore neither head cover nor apron, and did not wash their hands after using toilet. The workers drank tap water without boiling. They also used tap water for washing. Water privy with poor sanitation and inadequate washing sinks and soap were used. There were inadequate trash bins and most of them did not have the cover.

People lived around the factory used tap water, pond water and groundwater. One community in this subdistrict used untreated water from the pond which was about 30 meters away from the factory.

Second cluster

Most persons also ate food with their hands, shared the spoons, and did not wash their hands before eating and after using toilet. They usually cooked food for themselves meal by meal. They used tap water without boiling for drinking and washing. They also used water privy with poor sanitation.

Third cluster

In this event, people cooked different menus at home and brought to the temple to offer foods to monks for a religious ceremony. Afterwards, they gathered and consumed the foods together. No foods were prepared at the temple. Most of them used bottled water for drinking and village tap water for washing. Some of them used pond water and groundwater. They used good sanitation water privy. Although there were adequate trash bins in this area, some of them were not covered.

Actions Taken

Non-pharmaceutical Interventions

We educated the workers, food handlers and the public to improve sanitation such as immediately eating of cooked food, reheating the left-over food before eating, washing hands before eating and after using toilet, boiling water for drinking, chlorinating the public water, and disinfecting the environment using benzalkonium chloride and hypochlorite. We also contacted Phitsanulok provincial health office to follow up the case who came from Phitsanulok Province.

Pharmaceutical Interventions

After rectal swabs were taken, chemoprophylaxis (3-day oral norfloxacin in non-pregnant or erythromycin in pregnant) was given to those who had positive culture for cholera (34 cases and 7 asymptomatic persons) and were followed up for adequate management. Repeated testing of rectal swabs was performed after completion of treatment until all negative results were obtained.

Discussion

This event was considered to be an outbreak due to sudden increase in cholera cases with epidemiological linkage between cases occurred in nearby subdistricts; however, there was no clear linkage among these three clusters. Cholera outbreak usually occurred in crowded living conditions such as in migrant workers camps, as seen in this factory. Moreover, sanitation and hygiene were also inadequate[15,9,16-17] among the cases. The infection could spread to nearby communities same as previous outbreaks in this area.[9]

Although we could not identify the exact sources of infection, it was found that cholera could spread across the Thai-Myanmar border, as seen in the previous outbreaks in this area.[9] All three outbreaks revealed the same organisms with similar drug sensitivity.

Food handlers often play a major role in foodborne disease, spreading through poor food handling techniques.[18,19,20] However, all food specimens in this outbreak were negative for cholera. It might be due to multiple sources of foods in the factory, the ceremony, and all families. Furthermore, this outbreak might be associated with waterborne transmission due to inadequate concentration of residual chlorine though all water specimens were negative for cholera.

The reason of delayed detection of the outbreak might be due to limited access to medical care services among the migrants. Some cases in the first cluster did not visit public health facilities, as found similarly in previous outbreaks[9,18,21].

The cholera pathogen might have been spread from the recent outbreaks along the Thai-Myanmar border, as the first confirmed case of 2015 in Tak Province was found on 4 Sep 2015 in Umphang District.[10] Rectal swab culture revealed *V. cholerae* O1, El Tor,

Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline). Furthermore, in October 2015, 12 villagers had died and 61 villages suffered from cholera outbreak in Kawkareik and Kyain Seikgyi Townships near the Thai-Myanmar border in Kayin State, Myanmar.[22]

Limitations

We had some limited permission for investigation from the factory's owner due to illegal employment of their workers. In addition, some workers were not cooperative due to poor insight or misunderstanding about the disease.

Some cases had taken self-medication before rectal swabs were conducted, and this could have resulted in false negative tests. Some suspicious foods could not be collected for testing. Furthermore, genetic lineage of pathogens from the three clusters had not been proved for its similarity.

For disease control, chlorination could not be done in all water supplies. Food reheating was quite difficult for the workers in the factory.

Language barrier was a major problem and could cause miscommunication between public health officers and the migrants.

Public Health Recommendations

Communities

Migrant workers were encouraged to go to hospital or health promotion hospital for proper management.

The factory's owner and all workers were educated about importance of outbreak investigation and control. The factory's owner was also encouraged to provide instruments for reheating food or inform food sellers to provide only single-served portion of food so that the workers could finish them within one meal without any reheating process needed.

Health Sectors

The Provincial Waterworks Authority was contacted for adequate chlorination of tap water. People were educated about the disease and encourage them to improve sanitation, and monitor the situation until the outbreak was controlled.

Migrant health volunteers should be trained for translating and assisting in disease prevention and control.

Conclusions

This cholera outbreak occurred among Myanmar migrant workers in a garment factory and extended to nearby communities in Mae Sot District, Tak Province. Multidrug-resistant *V. cholerae* O1, El Tor Ogawa was the pathogen in this outbreak which might be related to the recent outbreaks in Umphang District, Tak Province. Rapid response and appropriate control measure were the keys of success in this outbreak control.

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Suggested Citation

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A Large Scabies Outbreak at a Prison in Southern Thailand, April-August 2017

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Abstract

Scabies is a neglected contagious skin disease and mostly occurs in crowded environment. After an increase in scabies cases at a prison, an investigation team was deployed. The objectives were to describe the epidemiological characteristics of cases, identify risk factors for infection and implement control measures. We defined a scabies confirmed case as a person with at least one itchy skin lesion, and diagnosed as scabies by both a physician and a dermatologist. We inspected the prison environment and observed sanitation practices. A case-control study was conducted among male inmates to identify risk factors for scabies. The overall attack rate was 29.4% among inmates. All 251 confirmed cases were typical scabies and 250 were male. The environmental inspection revealed poor hygiene and overcrowded at men's zones. Sharing a bedroom (Adjusted odds ratio AOR = 9.72, 95% CI = 5.33-14.73) and sharing clothes with cases (AOR = 3.61, 95% CI = 1.66-7.84) were significantly associated with having scabies. After interventions of setting scabies surveillance, separation of new comers, universal treatment for all inmates, and disinfection of bedrooms, bedding and clothes with detergents, no more new cases were found. Improving sanitation especially in bedrooms, enhancing scabies detection, and early interventions after case detection could help prevent scabies outbreak in prisons.

Keywords: Scabies, outbreak, prison, Thailand, control measure

Introduction

Human scabies is a common skin disease, caused by the infestation of mites (*Sarcoptes scabiei var. hominis*).[1] According to the World Health Organization, the global prevalence ranges between 0.2-71%.[2,3] Scabies is highly contagious and usually spreads by direct, skin-to-skin contact for around 20 minutes.[4,5,6] The scabies diagnosis is mainly made by clinical suspicion, possibly followed by identification of mites.[7] The known risk factors include extreme age, poverty and living in a crowded condition.[2,8]

There are two categories of scabies: typical and crusted. Typical scabies caused itchy rash between fingers by low number of scabies mite. Crusted scabies is triggered by large number of mites, it appears with widespread scale and crusted without significant itching, and results in high mortality if untreated.[2,6,9,10]

In Thailand, scabies outbreaks commonly occur in crowded institutions such as hospitals, nursing homes, schools and prisons.[6,11,12,13,14] In 2017, there were approximately 2,500 scabies cases reported from all prisons monthly.[15] Even a protocol of control and prevent of scabies was announced to eradicate scabies from prisons in March 2017[15], the scabies outbreak in prisons still occurred. Furthermore, risk factors of scabies infection among prisoners were not well identified so that most effective interventions can be implemented.

On 30 Aug 2017, the Department of Disease Control, Ministry of Health was notified of a scabies outbreak at a prison in the southern Thailand. Over 200 inmates were reported to have itchy rash within 10 days. An interdisciplinary team from the Department of Disease Control, the Office of Disease Prevention and Control 11, and the district hospital jointly conducted an investigation. The objectives of the investigation were to confirm the outbreak, describe the epidemiological characteristics of the cases, identify the risk factors for scabies infection and implement control measures.

Methods

Outbreak Setting

The prison is located in the southern part of Thailand and only accepts inmates aged over 18 years. The detention period of inmates has to be lower than 15 years. The inmates are detained or released every week. There are four zones in the prison, including zones A-C for male and D for female. As of 1 Sep 2017, 911 people were in the prison, including 56 prison officers and 855 inmates. Of all inmates, 685 were male and 170 were female, with a gender ratio of 4:1. In each zone, they spent 10 hours in the shared bedroom during the night, and during the day at dining area, workspace and bathroom. When inmates were sick, symptomatic treatments were provided at the first-aid unit of the prison. If the symptoms persisted or worsened, the ill inmates were sent to the district hospital for further evaluation and treatment.

Case Finding and Outbreak Investigation

Active case finding was carried out in the prison. To identify the magnitude of scabies in the prison, all electronic medical records of the district hospital were reviewed from 1 Jan 2014 to 31 Aug 2017, based on the international classification of diseases (ICD) 10 diagnosis codes for scabies (B86) and dermatitis (L20, L21, L23, L25, L30). All inmates and prison officers were also screened for any skin lesions. People with specific diagnosis codes or skin lesions were examined by a primary care physician and a dermatologist.

We defined a suspected case as a person with at least one itchy skin lesion and clinically diagnosed by a physician as scabies. A confirmed case was a suspected case confirmed by a dermatologist, or skin scraping test positive for scabies mites. For environmental inspection, inmates and prison officers were interviewed about the personal hygiene regulations, disinfection activities and outbreak interventions. We also observed the setting of prison and calculated the average population density in every zone.

Case-control Study

An unmatched case-control study was performed among male inmates to identify risk factors associated with scabies. Information of all male inmates such as demographic data, signs and symptoms, activities and risk behaviors (direct contact with a suspected person at any places, sharing bedroom/dining area/personal belongings with any suspected cases) were also collected by administering a questionnaire through face-to-face interviews. We compared features of inmates with confirmed scabies (cases) and inmates with no itchiness or any skin lesions (controls) during 1 Apr - 1 Sep 2017. We planned to enroll 180 cases and 180 controls selected by random sampling in the case-control study.

Data were analyzed by Epi Info version 7.2.0.1. Univariate and multivariate analyses were conducted using logistic regression to identify factors associated with scabies using odds ratio (OR) with 95% confidence interval (CI). The factors with p-value less than 0.1 from univariate analysis were eligible to be included in the initial multivariate model. If two factors were highly correlated with absolute R more than 0.7, one with higher OR were chosen. Then, in the final model of multivariate analyses, the factors with p-value equal or more than 0.05 were excluded.

Results

Case Finding and Outbreak Investigation

There were no sporadic cases of scabies among inmates during 2014-2016 by reviewing the electronic medical records. However, 10 inmates were diagnosed as scabies in April 2017 with individual treatment. Overall, we identified 268 suspected cases; all of them were inmates. Among them, 251 were confirmed, including 250 (99.6%) male. The overall attack rate among inmates was 29.4%. The median age of confirmed cases was 29 years (range 19-58 years). There were no hospitalized or severe cases. Thirteen (5.2%) cases had underlying diseases such as diabetes mellitus and human immunodeficiency virus (HIV), including a psychosis patient with cellulitis as a complication. All cases were diagnosed as typical scabies.

All of the cases reported general itching (100%), along with a history of rash (93.2%) and night itching (84.1%). The most common skin manifestation was vesicle (62.2%) and mostly on the fingers. Of all male scabies cases, 88.0% had directly contacted other prisoners and 26.7% had shared personal belonging with others (Table 1). A total of 176 skin scraping samples from the suspected cases with visible or severe skin lesions were tested and scabies mite was not found.

The outbreak started in April 2017, with the peak in August 2017. After the investigation team recommended all prisoners to apply 25% benzyl benzoate simultaneously on 1 Sep 2017, no more cases were identified (Figure 1). The area with highest attack rate in men's zone was in floor 2 of zone A at 53% (133/251).

Table 1. Characteristics of confirmed scabies cases in a prison, southern Thailand, 2017

Characteristic	Case	Percent
Gender		
Male	250	99.6
Female	1	0.4
Age group (year)		
19-29	120	51.3
30-49	101	43.2
50-58	13	5.5
Zone		
A	203	83.9
B	38	15.7
C	0	0
D	1	0.4
Underlying disease		
Diabetes	2	0.8
HIV infection	2	0.8
Psychosis	1	0.4
Others (asthma, allergic rhinitis, gastritis)	8	3.2
Symptom		
Itching	251	100
History of rash	234	93.2
Night itching	211	84.1
Skin manifestation		
Vesicle	156	62.2
Rash	146	58.2
Excoriated	128	51.0
Tiny linear burrow	10	4.0
Lesion distribution		
Finger web	166	66.1
Buttock	111	44.2
Chest	106	42.2
Genitalia	98	39.0
Risk behavior		
Direct contact with others	221	88.0
Sharing personal belongings	67	26.7
Lifelong history of scabies	41	16.3

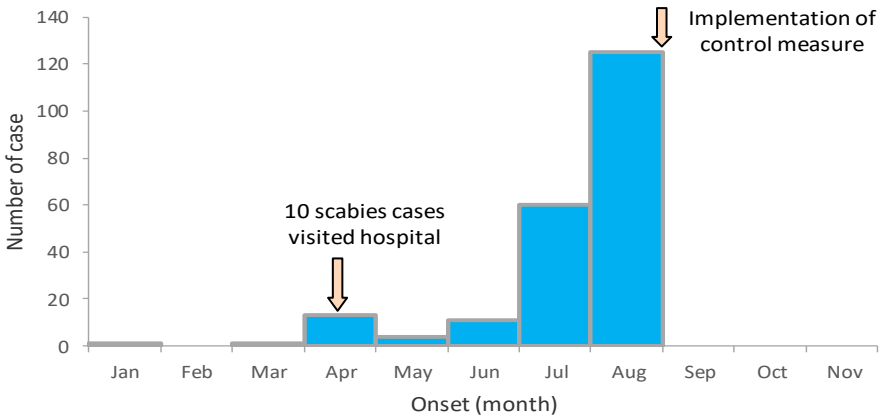
There was only one female case, who had been assigned to wash the male inmates' blankets in July 2017. Two weeks later, she developed itchiness and rash, and was diagnosed as scabies. She reported that she did not have any contact with male inmates.

In men's zone A, the average living area per inmate was 0.5 m^2 per person, with the lowest as 0.4 in the most crowded room. Each inmate was provided with three pieces of clothes (pillow, blanket and bedsheet). In men's zones, inmates in each room usually mixed all pieces of clothes together and these pieces were washed only once a month. The floor was never cleaned with disinfectants. However, in women's zone, clothes were washed every week and rooms were cleaned with disinfectants daily. Some inmates from different zones could potentially interact during activities. Occasionally, inmates were moved to other zones during the detention.

Case-control Study

Of all male inmates, 159 cases and 186 controls were recruited in the case-control study. There were no statistical significant difference (p-value 0.05) for age and nationality between cases and controls. Compared with controls, cases were more likely to having direct contact, sharing room or clothes with suspected scabies (p-value <0.01) (Table 2).

Univariate analysis showed that variables related to sharing rooms or clothes with cases were significant, with OR as 11.37 and 5.44 respectively. There were 11 variables with p-value less than 0.1 from the univariate analysis. However, there were seven variables included in multivariate, after checking for correlation, data validity and exclusion criteria. In the multivariate analysis, the risk factors for scabies were sharing a bedroom (Adjusted OR = 9.72, 95% CI=5.33-14.73) and sharing clothes with cases (Adjusted OR = 3.61, 95% CI = 1.66-7.84) (Table 3).



**36 confirmed cases were not be able to indicate the onset date.*

Figure 1. Onset of confirmed scabies cases* in a prison, Southern Thailand, January-November 2017 (n=215)

Table 2. Characteristics of cases and controls in a prison, southern Thailand, 2017

Characteristic	Case (n=159)		Control (n=184)		P-value
	Number/Total	Percent	Number/Total	Percent	
Age group (year)					
19-29	80/154	52.0	77/158	48.7	0.05
30-49	63/154	40.9	78/158	49.4	
50-58	11/154	7.1	3/158	1.9	
Nationality					
Thai	141/155	91.0	145/159	91.2	0.94
Non-Thai	14/155	9.0	14/159	8.8	
Duration of stay					
<6 months	36/153	23.5	68/156	43.6	<0.01
6-12 months	59/153	38.6	38/156	24.4	
>1 year	58/153	37.9	50/156	32.0	
Underlying disease					
Diabetes	2/159	1.3	1/184	0.5	0.48
HIV infection	2/159	1.3	2/184	1.1	0.88
Risk behavior					
Location of direct contact with suspected scabies					
Any place	150/159	94.3	120/182	65.9	<0.01
Bedroom	141/158	89.2	94/178	52.8	<0.01
Workspace	85/158	53.8	58/178	32.6	<0.01
Dining area	70/158	44.3	48/178	27.0	<0.01
Bathroom	73/158	46.2	54/178	30.3	<0.01
Location of sharing room with suspected scabies					
Bedroom	133/158	84.2	58/182	31.9	<0.01
Dining area	104/155	67.1	75/161	46.6	<0.01
Type of shared belonging with suspected scabies					
Clothes	50/157	31.9	14/177	7.9	<0.01
Bedsheet	12/155	7.7	3/159	1.9	0.02
Locker	115/155	74.2	105/159	66.0	0.12
History of scabies	17/159	10.7	19/159	10.3	0.89

Table 3. Univariate and multivariate result of risk factors for associated with scabies among male prisoners in a prison, southern Thailand, 2017

Characteristic	Univariate		Multivariate	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Location of direct contact with suspected scabies				
Anyplace	8.61	4.11-18.03	-	-
Bedroom	7.41	4.14-13.28	-	-
Workspace	2.41	1.55-3.75	1.45	0.73-2.87
Dining area	2.15	1.37-3.40	0.72	0.34-1.50
Bathroom	1.97	1.23-3.08	1.16	0.58-2.31
Location of sharing room with suspected scabies				
Bedroom	11.37	6.70-19.30	9.72	5.33-14.73
Dining area	2.34	1.48-3.69	1.36	0.73-2.53
Type of shared belonging with suspected scabies				
Clothes	5.44	2.87-10.33	3.61	1.66-7.84
Bedsheet	4.36	1.21-15.78	2.17	0.50-9.46

Intervention Measures

The investigation team recommended several interventions measures for all prisoners (100% compliance), including applying 25% benzyl benzoate on the same day for three consecutive days and repeat the protocol in the following week, regular mopping of the bedroom every day with disinfectants and washing of the bedroom equipment every week. Inmates must wash their clothes with strong detergents and dry under the sun.

Scabies surveillance was set up by screening all prisoners, including both existing and newcomers for

suspect skin lesions, followed by isolating suspected cases. To ensure compliance and effectiveness of the control measures, external public health staff closely monitored the prison with regular visits of the physician from the district hospital. No adverse effect from universal scabies treatment was reported and no case was found after September until December 2017.

Discussion

We reported a scabies outbreak in a prison in Thailand with a high attack rate about 30%. We found that delay in case detection and applying control measures led to a large outbreak. Male inmates who shared the bedroom with cases were more likely to be infected than other male inmates. Scabies outbreak is an important, yet often neglected public health problem in institutional settings[9], especially in the prisons[4]. The findings in this study demonstrated that scabies outbreak could be effectively controlled by intensive control measures.

Due to its contagiousness, delayed diagnosis of scabies could increase the risk of disease spreading.[16] The outbreak had likely started in April 2017. However, the first case was reported in late August 2017. Some cases were underdiagnosed because of insufficient ability to identify scabies in prisons. Suspected scabies cases had to be transferred to the district hospital for diagnosis and treatment. Previous studies also showed that poor recognition of initial cases predisposed to scabies outbreaks in Thai prisons.[16] Compared with the scabies outbreaks in other settings[10,11,17,18], the recognition of the disease in this outbreak was delayed and then led to delayed implementation of control and preventive measures To improve case detection and prevent further disease transmission, it is crucial to follow the national scabies control and prevention guidelines, including establishment of surveillance to detect cases in prison[19,20,21], screening the newcomers, and universal treatment for all inmates in the same bedroom with cases.

Transmission through direct contact was commonly reported in previous outbreaks.[9,12,22] In this outbreak, not only direct contact[4] that increase risk of disease transmission, but indirect contact through room sharing, equipment sharing and poor sanitation in male dormitory also played an important role in accelerating disease spreading. Similar to findings from this outbreak, a previous report showed that almost all prisons in Thailand were facing the same overcrowded conditions[15]. To better manage in future outbreaks, the protocol implemented in this outbreak, including cleaning the bedroom daily, washing bedroom equipment weekly with disinfectant detergent to keep better hygienic condition, should be applicable in other prisons for preventing spread of scabies mites and other direct contact pathogens.[9,19,17]

Limitations

Our study was subjective to at least three limitations. First, we did not identify scabies mites from any skin scrapping of cases. Although no positive laboratory sample for scabies mite, the diagnosis was very likely to be scabies due to the compatible clinical manifestations and good response to scabicidal treatment. Second, inability to access medical records in the prison might under-estimate the exact number of cases. To reassure number of cases and diagnosis, we gathered more information of cases from the medical records and also invited clinicians to help examining the inmates.

Finally, recall and memory biases might happen among inmates during administering questionnaires, because of long incubation period and delayed interventions. For instance, one-month interval was applied to time axis of epi-curve instead of shorter interval due to imprecise information on onset and bedroom zone among control group, frequent change during outbreak period, and therefore, excluded from the analytic study.

Conclusion

Delayed diagnosis, poor sanitation and overcrowded environment were likely lead to the scabies outbreak in this prison. Proper intervention measures, including setting up surveillance, universal treatment for all inmates, and cleaning bedroom daily and equipment weekly with disinfectants such as detergent[23] could prevent and control outbreaks in prisons. We recommended all prisons in Thailand to follow both the intervention measures and the national guidelines.

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Migrant Policies in Thailand in Light of the Universal Health Coverage: Evolution and Remaining Challenges

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Global Movements, Criticisms and Challenges on Migrant Health

At present, there exists a need to share responsibility and expectation of global support in addressing needs of international migrants. So far, there have been a number of global agreements in the past several years to facilitate the implementation of health policies towards migrants.

In 2016, the United Nations General Assembly unanimously adopted the 'New York Declaration for Refugees and Migrants'.[1] The declaration underlined a need for more cooperation among nations towards effective management of migration and negotiation on the 'Global Compact for Safe, Orderly and Regular Migration', which was later endorsed in 2018.[2]

In 2017, the World Health Assembly (WHA) endorsed a resolution, 'Promoting the Health of Refugees and Migrants' (WHA 70.15), leading to the development of the 'Draft Global Action Plan, 2019-2023' in 2019.[3] These agreements were supported by Thailand and many other countries.[4] During negotiation of such agreements, there were debates and criticisms, particularly on issues of shared responsibility and ownership of countries, clarification of roles among key stakeholders, distinction between illegal and legal migrants, and commitment of member states to implement actions specified in the agreements while maintaining national sovereignty (Table 1).

Thailand and Universal Health Coverage at a Glance

Universal Health Coverage (UHC) is both path and principle to ensure that all people are able to access standard health services, without incurring financial hardship.[5] It is now one of the global targets in the Sustainable Development Goals.[6,7] Thailand has achieved UHC since 2002, which is attributed to continuous investment in health workforce and health care infrastructures for over 30 years, combined with a critical health financing reform.[8]

At present, there are three main public insurance schemes in Thailand. First is Civil Servant Medical Benefit Scheme which covers Thai civil servants, constituting around 9% of total population. Second is Social Security Scheme (SSS) for private employees in the formal sector, numbering about 15% of total population. Third is Universal Coverage Scheme (UCS) for the majority of Thai citizens (75% of total population).[9] All of the three schemes have been successful in improving health of Thai citizens and protecting them against catastrophic expenditures.[10] All of these accounts made Thailand gain remarkable achievement as one of the UHC champions in global health arena[11] (Table 2).

Linkage between UHC and Migrants

Theoretically, UHC means 'universal protection' for all populations. Yet, practically, there is always a fundamental question, to what extent the term 'population' covers. Does it cover the native residents only? Does it include anyone living in the country border? This issue becomes more complex when dealing with non-Thai population. Most of them are migrant workers and their dependents, numbering around 3.1 million. This figure has not included undocumented migrants who are untraceable by the government.

Table 1. Key characteristics of selected important international agreements on migrant health

Agreement	Key substance
New York declaration for refugees and migrants (Resolution 71/1)[1]	• Leading to 2 main concrete actions: (1) initiating the draft on Global Compact for Safe, Orderly and Regular Migration and (2) initiating guidelines on the treatment of migrants in vulnerable situations
Global compact for safe, orderly and regular migration[2]	• Support the development of evidence-based migration policy (ensuring proven identity, enhancing availability and flexibility for regular migration, access basic services, and making provisions for both full inclusion of migrants and social cohesion) • Emphasising principles of national sovereignty (reaffirming the sovereign rights of a country to determine its national migration policy and its prerogative to govern migration within their jurisdiction, in conformity with international laws) • Making no distinction between illegal and legal migrants
World Health (WHA) Assembly resolution 70.15, 'Promoting the Health of Refugees and Migrants'[3]	• Focusing on strengthening international cooperation and partnerships on the health of refugees and migrants • Leading to the development of a Global Action Plan for consideration at the following WHA in 2019
Global Action Plan, 2019-2023[4]	• Following from the WHA resolution 70.15 • Asserting health as an essential component of good migration governance • Key activities mainly confined in the WHO secretariat rather than the member states

Table 2. Key characteristics of the main three insurance schemes for Thai citizens at present[27,28]

Insurance scheme	Population coverage	Source of revenue	Mode of provider payment	Access to service
Civil Servant Medical Benefit Scheme (CSMBS)	~9%, government employees plus dependents (parents, spouse, and up to 2 children)	General tax, noncontributory scheme	Fee for service, direct disbursement to mostly public providers and Diagnostic Related Groups (DRG) for inpatient treatment	Free choice of public providers
Social Security Scheme (SSS)	~16%, private sector employees, excluding dependents	Tripartite contribution, equally shared by employer, employee and the government	Inclusive capitation for both outpatient and inpatient plus additional adjusted payments for accident and emergency and high-cost care	Registered public and private contractors
Universal Coverage Scheme (UCS)	~75%,the rest of the 'Thai' population not covered by SSS and CSMBS	General tax	Capitation for outpatients and global budget plus DRG for inpatients	Registered contractors, notably the network of public hospitals (Contracting Unit for Primary Care)

Over 90% of them are from Cambodia, Lao PDR and Myanmar, so-called CLM migrants.[12] The CLM migrants are mostly engaged in dirty, demeaning and dangerous jobs.[13] The rest 10% is a group of well-off non-Thai, including professional workers and expatriates who are already covered by either private insurance or SSS. Low-skilled migrant workers working as employees in the formal sector have to be enrolled in SSS while those in the informal sector (such as fishermen, farmers, and housemaids) are to be insured with Health Insurance Card Scheme (HICS) of the Ministry of Public Health (MOPH).

Protecting health of migrants is not only a matter of health. In fact, it means a protection of the national macro-economy. Recent report by the International Labour Organization suggested that in 2010, migrant workers contributed around 4.3-6.6% of gross domestic product in Thailand.[14] This figure represented 4.7% of the employed population.[14]

Since CLM migrants constitute the greatest share of non-Thai population in Thailand, most policy dialogues on migrant health so far have been centered on CLM migrant workers and their dependents. One of the greatest complexities of this issue is that a large amount of CLM migrants are (and can be) undocumented at certain periods of their lives. Thus, the term 'undocumented' in this regard means that they once entered Thailand without legitimate travel documents, or dependents were born

in Thailand without registering for a birth certificate. Therefore, a provision of health care cannot be functioned effectively unless measures to remedy the precarious legal status of migrants are in place.

Health Insurance Card Scheme - One of the Most Remarkable Policies on Migrant Health in Thailand

The health-protection policy for migrants started in early 1990s. During that period, the government proclaimed public health insurance for migrants in certain industrialized provinces until 2004 when there was an establishment of public insurance for migrants, namely, HICS, for the whole country.[15]

The benefit package of HICS is quite similar to UCS, including out-patient, in-patient and emergency care, and high-cost treatments. HICS is financed by annual premium paid by migrants. Note that during the start-up period, the HICS benefit still excluded HIV/AIDS treatment with an annual at 1,300 Baht (USD 39) plus 600 Baht (USD 18) for a pre-enrollment health check.[15,16]

In 2013, HICS faced the important milestone in its evolution. The cabinet at that time approved to include HIV/AIDS treatment in the HICS benefit package.[16] Besides, HICS extended its enrollment eligibility to cover undocumented migrants' dependents, aged below seven years. However, to be insured with HICS, these undocumented migrants were obliged to register with the government to undertake the 'nationality verification' (NV) and acquire 'work permit' from the Ministry of Labour first. In other words, NV serves as a legalization process for undocumented migrants. Before enrolling in HICS and obtaining a work permit, applicants must undertake health screening for detect serious communicable diseases that can pose public health threats such as active tuberculosis, syphilis, leprosy and filariasis.[15]

In 2014, there was a critical change in the migrant policies again. A new measure, namely, the One Stop Service (OSS) was instigated.[17] The OSS is aimed to serve as a synergistic platform for different authorities, namely, Ministry of Labour, Ministry of Interior and Ministry of Public Health. At the end of 2014, the number of formerly undocumented migrants who had already passed NV amounted to over 1.5 million, far greater than the previous NV processes prior to the OSS era.

There are some operational details necessitating special considerations: one of which is the interaction between SSS and HICS. Migrants registered with the OSS are required to be insured with either SSS or HICS, depending on the nature of work. Those working as an employee in the formal sector are obliged to be insured with SSS while those in the informal sector need to be insured with HICS. Nonetheless, in practice, to be enrolled with SSS, a (potential) insuree needs to complete NV first and generally the whole NV process takes a while until completion. Thus migrants with unfinished NV are still obliged to be insured with HICS even though they are engaged in the formal sector.

In 2014, the HICS premium reduced to, 365 Baht (USD 11) per year for a migrant child, and 1,600 Baht (USD 49) a migrant adult plus 500 Baht (USD 15.2) for the preconditioned health check.[15] Moreover, HICS for a migrant adult is classified into several subtypes with a less-then-one-year validity period. This sub-arrangement is made so as to cover migrants working in private enterprises who will be soon be enrolled in SSS, but have not completed the SSS contribution requirement. Normally, a SSS beneficiary requires to have his/her wage deducted to SSS for at least three months as a precondition in activating the rights to enjoy services.

Chronological evolution and key features of migrant insurance policy in Thailand are excerpted in table 3.

It is worth mentioning that there have been another group of non-Thai, namely, stateless people, residing in the country for years. The majority of them are hill-tribe residents and highlanders who fled from neighboring countries due to political conflicts. However, due to several reasons (such as ignorance of the civil registry system, poverty and geographical barriers), they missed the opportunity to register for their citizenship status and neither did their dependents. The estimated number of stateless people is 500,000-700,000 all over the country.[18] In 2010, the cabinet proclaimed the insurance policy specifically for this population, so-called, 'Health Insurance for People with Citizenship Problems' (HIS-PCP).[19] The insurance is financed by central budget of MOPH, with the benefit package almost comparable to UCS.[18] However, HIS-PCP is beyond the scope of this paper and it needs more space to discuss further in detail on its operational constraints and remaining challenges.

Direction of the Government to Address the Health of Migrants

Aside from the insurance policy, MOPH has launched the Border Health Plan as a guideline for all public facilities to provide care for migrants.[20] The plan emphasizes the importance and benefit of migrant friendly service. To this end, migrant health workers

Table 3. Chronological evolution and key characteristics of several subtypes of the insurance card for migrants

Card	Premium	Coverage length	Beneficiary	Stating year	Benefit package	Legal basis
Health Insurance Card for 'migrant'	1,300 Baht + 600 Baht for health check	1 Year	Migrant workers	2004	Out-patient, in-patient, and health promotion, disease prevention services but excluding HIV/AIDS treatment, mental diseases and drug dependence, and chronic dialysis	Cabinet Resolution
Health Insurance Card for 'migrant'	2,200 Baht + 500 Baht for health check	1 Year	All non-Thai populations, except for tourists, and Caucasian foreigners	2013	Out-patient, in-patient, and health promotion, disease prevention services but excluding HIV/AIDS treatment, mental diseases and drug dependence, and chronic dialysis	Cabinet Resolution
Health Insurance Card for 'migrant child'	365 Baht	1 Year	Migrant child aged less than 7	2013	Out-patient, in-patient, and health promotion, disease prevention services but excluding HIV/AIDS treatment, mental diseases and drug dependence, and chronic dialysis	Cabinet Resolution
Health Insurance Card for 'migrant worker'	1,600 Baht + 500 Baht for health check	1 Year	Migrants who registered with the One Stop Service by 31 October 2014	2014	Same as 2013	National Council for Peace and Order
	900 Baht + 500 Baht for health check	6 months	Migrants who registered with the One Stop Service by 31 October 2014	2014	Same as 2013	National Council for Peace and Order
	500 Baht + 500 Baht for health check	3 months	Migrants who registered with the One Stop Service by 31 October 2014	2014	Same as 2013	National Council for Peace and Order
Health Insurance Card for 'a child of migrant workers'	365 Baht	1 Year	Child of migrant workers, aged less than 7, registered with the One Stop Service by 31 October 2014	2014	Same as 2013	National Council for Peace and Order

Source: adapted from the Health Insurance Group, Ministry of Public Health, Thailand[16]

(MHWs) and migrant health volunteers (MHVs) are promoted. The functions of MHWs and MHVs include not only being a translator for migrant patients in the Thai public facilities, but also providing outreach health education to migrant communities.[20,21]

The attempt to include migrants in the public insurance arrangement became more materialized in 2017, when the Thai government endorsed a 20-year Master Plan for Integration of Health Insurance Systems Development (2018-2037).[22] The plan is chaired by the Deputy Prime Minister, with a purpose to ensure that everybody in Thailand is covered by at least one of the public insurance schemes and is able to maximize their health potentials. Such a political momentum coincides with the Vision of the National Health Security Office, the governing body of UCS, which clearly emphasizes that everybody on the Thai soil, regardless of their ethnic status, should be insured for their health by any of public insurance arrangements.[23]

Besides, Thailand has supported the ASEAN Declaration on the 'Protection and Promotion of the Rights of Migrant Workers' since 2017.[24] The declaration reflects a political commitment and progress towards better protection for health of migrants not only in Thailand, but also in the whole Southeast Asia region.

Remaining Challenges and Future Ahead

Despite several initiatives on migrant health, challenges still remain as presented in the following examples. First, the NV process is a longish task and cannot be achieved without seamless coordination between sending and receiving countries, which hardly happen in reality.

Second, though the HICS in intended to be a compulsory scheme for all migrants, in practice there are some migrants failing or refusing to register with HICS or OSS. The number of these migrants remains in question. In addition, so far, there have not been any laws or regulations that indicate penalty on migrants who refuse to buy HICS or employers of migrants who leave their migrant employees uninsured. In other words, HICS is not truly compulsory as intended; its status is rather 'semi-compulsory'.[25] Third, the employment status of a migrant is never static. Portability of one scheme to another, SSS to HICS and vice versa, is still a critical challenge. Fourth, the unsynchronized data management systems across authorities always hamper effective implementation of migrant health policies.

Fifth, there remains a small, but significant discrepancy between HICS and UCS benefit packages, which is treatment for mental health diseases and drug dependence. Strictly speaking, psychiatric diseases are amongst diseases in the negative list specified in the immigration law. Migrants suffering from the negative-list diseases are prohibited from entering the country.[26] However, the process of deporting these migrants is unclear and beyond the authority of the health sector. Thus, it is very likely that these migrants are neither able to enjoy services, nor deported back to their homeland. Last but not least is a variety of societal attitudes and diverse legal interpretations towards migrants, which definitely shape how migrants receive service in reality.[25]

Conclusion

Thailand has travelled far in the quest towards universal protection for 'everybody' on its land. Lessons from Thailand show that protecting health of migrants must come alongside a proper remedy on precarious legal status of migrants, especially the undocumented ones. Promoting health and well-being of migrants should be viewed as a sensible investment for the society rather than service burden. Finally, the synergistic effort and policy coherence from all relevant stakeholders are extremely indispensable to ensure health of the whole nation.

Suggested Citation

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