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Evaluation of Dengue Surveillance System in Vientiane Capital City, Lao People's Democratic Republic, 2010

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Abstract

In July 2010, we evaluated the dengue surveillance system in Vientiane Capital City (VCC) to provide recommendations for improvement of the system. We interviewed 29 stakeholders from the Department of Health, and one central and two district hospitals in VCC. Sensitivity and predictive value positive (PVP) were calculated using dengue data from June to July 2009 and June 2010. In addition, timeliness of reporting and data quality in June to July 2009 were also evaluated. The surveillance system was simple and paper-based, with both passive and active components. There were no designated surveillance officers in the central hospital. In 2010, the Department of Health provided training and frequency of data collection was increased. Overall sensitivity increased from 50% in June-July 2009 to 68% in June 2010. However, sensitivity decreased in the central hospital where higher number of patients was found. PVP was 100% in June-July 2009 and 96% in June 2010. Sixty percent and 32% of patients were reported within one week after diagnosis in the central and district hospitals respectively. Proportion of accurate data was more than 90% for case classification, gender and age. Sensitivity of surveillance improved with training and active surveillance. However, active surveillance only increased sensitivity when the caseload was not high. To improve the system, there should be designated trained surveillance staff in central hospitals and date of onset for each patient should be collected.

Key words: dengue, surveillance system, Vientiane Capital City, Lao People's Democratic Republic

Introduction

Dengue is the most rapidly spreading mosquito-borne viral infection, with a broad spectrum of illness ranging from febrile illness to fatal outcome.[1,2] Dengue inflicts substantial health, economic and social burden on the population, especially in most tropical and sub-tropical countries.[3-6]

Dengue has been nationally reportable to the National Centre for Laboratory and Epidemiology (NCLE) in Lao PDR since 1998. There are six central hospitals, nine district hospitals and 42 health centers in Vientiane Capital City (VCC), with a population of 783,032 and an area of 3,920 km^2.[7] Among all dengue cases in Lao PDR, the proportion reported in VCC rose sharply from 12% in 2008 to 28% in 2009, according to the data from NCLE.

Surveillance is a critical component of dengue prevention and control program as it provides necessary information for risk assessment, epidemic response and program evaluation.[1] However, since its establishment, the dengue surveillance system in VCC had never been assessed. Therefore, in July 2010, we evaluated the dengue surveillance system in VCC to describe its attributes and provide recommendations for improvement of the system.

Methods

We employed both qualitative and quantitative methods as described in the updated guidelines for evaluating public health surveillance systems from US CDC.[8] Our study was part of the cross-border dengue surveillance system evaluation program between Thailand and Lao PDR. The study sites in VCC included the Department of Health under Ministry of Health, one central hospital (Mahosot Hospital) and two district hospitals (Sikhottabong and Hadxaifong Hospitals) from the districts that border with Thailand.

Qualitative Study

In the Department of Health, the director and public health officers who were responsible for dengue surveillance and response were interviewed. In three hospitals, the interviewees included directors, clinicians and nurses from emergency rooms (ER), out-patient departments (OPD) and in-patient departments (IPD), and data managers and epidemiologists from two district health offices. Semi-structured questionnaires were used for face-to-face interviews with the stakeholders.

All components of the surveillance process were studied: data collection, reporting, data management, analysis, dissemination, utilization, policies and human resources. The qualitative attributes, including simplicity, acceptability, flexibility, stability and usefulness, were used for designing the questionnaire and interpreting the results. Group discussion was conducted to summarize information from the interviewers.

Quantitative Study

Hospital records of patients from three hospitals during June to July 2009 and June 2010 with a clinical diagnosis of dengue fever (DF), dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS) were eligible for this study. The study population also included DF, DHF and DSS patients who were reported from the three hospitals to the Department of Health during the same periods.

While sensitivity and predictive value positive (PVP) were evaluated for June to July 2009 and June 2010, data quality and timeliness were calculated only for June to July 2009.

Sensitivity of case reporting was defined as the proportion of reported cases among all patients with clinical diagnosis of DH, DHF or DSS while PVP was the proportion of patients with clinical diagnosis of dengue among reported cases.

Sensitivity of outbreak detection was defined as the proportion of reported dengue outbreaks among all outbreaks detected by reviewing hospital records of dengue patients. To estimate sensitivity of outbreak detection, a dengue outbreak was defined as five or more dengue cases from one village admitted to a hospital within the same week.

Data quality describes the completeness and accuracy of key variables. Five variables were used to calculate proportions of complete and accurate data, including age, sex, date of admission, date of discharge and case classification (DF, DHF or DSS).

The length of time between date of diagnosis and date of reporting, and between date of dengue outbreak reporting and date of response were calculated to evaluate the timeliness of reporting and outbreak response.

Logbooks were reviewed to detect dengue cases in ER, OPD, IPD and intensive care unit (ICU) of the hospitals. Individual data of reported dengue cases were extracted from database in the Department of Health. Data were analyzed using Epi Info version 3.5.1 (US CDC).[9] Descriptive statistics were calculated, including proportions for categorical variables, and medians and inter-quartile ranges (IQR) for continuous variables.

Results

Qualitative Study

We enrolled 29 interviewees, including three hospital directors, six public health officers and epidemiologists, nine clinicians, eight nurses and three data managers.

Description on Dengue Surveillance System

Structures of the dengue surveillance system in VCC and district hospitals are showed in figures 1 and 2 respectively.

Data Collection and Reporting

Officers from the Department of Health visited six central hospitals to collect data every 1-2 weeks in 2009. In June 2010, they collected data every 2-3 days in response to dengue outbreaks. They searched for dengue cases by clinical diagnosis in logbooks and recorded information in a paper notebook. In Mahosot hospital, there were no surveillance officers responsible for data collection and reporting. However, epidemiologists in district hospitals reported individual dengue cases weekly and aggregate data daily to the Department of Health which then reported to NCLE every week.

Data Management, Analysis and Dissemination

Public health officers entered individual data and analyzed using spread sheet, without extensive analysis.

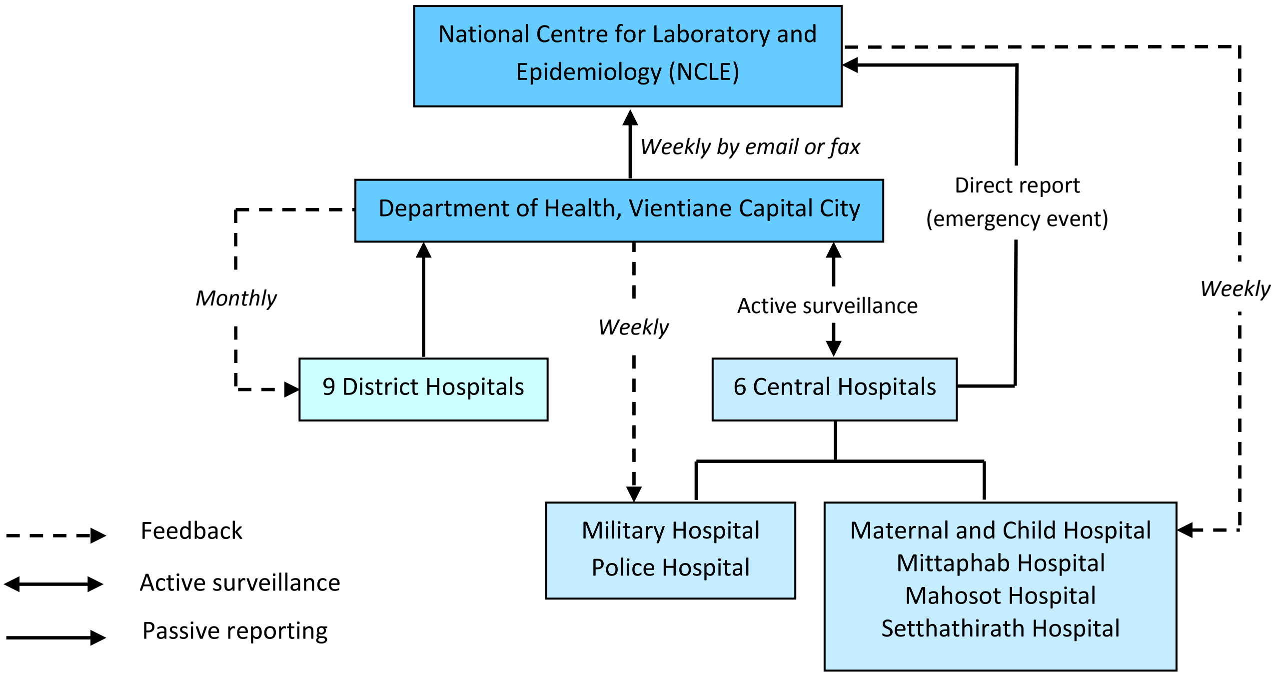

Figure 1. Operating structure of dengue surveillance system in Vientiane Capital City, Lao PDR, 2009-2010

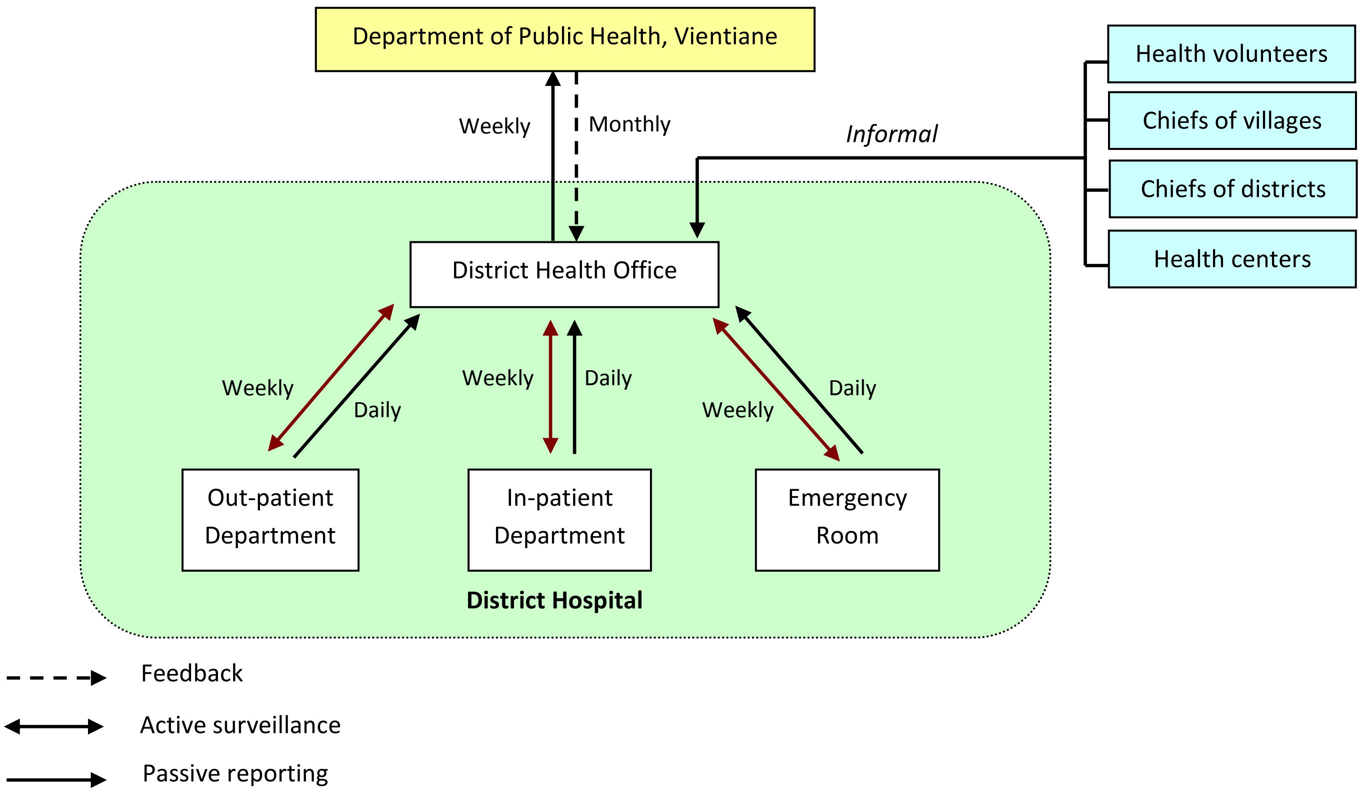

Figure 2. Operating structure of dengue surveillance system at district hospital in Vientiane Capital City, Lao PDR, 2009-2010

Then, they entered aggregate data into the electronic-based national weekly report program, Early Warning Alert and Response Network (EWARN), every week. Basic descriptive analysis could be done with this program, producing an automatic alert for unusual event (number of cases > mean of number of cases in previous three weeks + 2 standard deviation). The NCLE provided feedback to four central hospitals every week, including Mahosot Hospital, while the Department of Health sent to two central hospitals every week and district hospitals every month.

Data Utilization

Data were used to determine trend of dengue and predict the magnitude of outbreak. Epidemiologists utilized data for case investigation, vector control and health education in communities. Once an outbreak occurred, they shared the information with nearby hospitals and health centers. The clinicians and nurses reported that they expected to receive feedback in time and this would be very useful in preparing medicines and health care equipment, and informing clinicians to raise awareness of the potential dengue outbreak.

Policies and Human Resources

The directors recognized dengue as a priority disease of public health concern. Public health officers were provided trainings twice per year to improve data management, data analysis and outbreak response.

Financial support from WHO was sufficient for routine surveillance activities, but unable to cover expenses for unusual events, such as outbreaks. Regular government budget was used to maintain four public health officers responsible for collecting data from six central hospitals. There was only one epidemiologist in each district health office. These staff also had other duties, such as reporting other diseases, outbreak response and vector control. No one took care of their responsibilities when they were not available.

Quantitative Study

Sensitivity

Of 288 dengue cases identified during June to July 2009, 143 cases (50%) were reported. Hospital-specific sensitivity varied from 23% to 76% (Table 1). In June 2010, 68% (148/218) of cases were reported. Sensitivity of the hospitals ranged from 57% to 96%. Compared to 2009, sensitivity of the two district hospitals increased over 50%; however, there was 25% reduction at the Mahosot hospital.

During June to July 2009, we reviewed hospital data and surveillance data to explore whether dengue outbreaks had occurred in any village. Although it appeared that outbreaks might have occurred in seven villages according to the hospital data, the surveillance system was able to detect outbreaks only in four villages if it was utilized (Table 2).

Predictive Value Positive

PVP for all three hospitals from June to July 2009 was 100%. Although PVP of two hospitals in June 2010 were 100%, it decreased to 60% in Hadxaifong Hospital, resulting overall 96% for this period (Table 1). Although the actual diagnosis of six over-reporting cases in Hadxaifong Hospital was diarrhea, they were mistakenly reported as dengue.

Data Quality

Date of onset was not evaluated as it was not collected. No missing data was identified for all five variables. Proportions of accurate data were the highest for case classification (97%) and gender (97%), followed by age (94%), date of admission (85%) and date of discharge (79%).

Timeliness

During June to July 2009 in Mahosot Hospital, median between date of diagnosis and date of reporting was seven days (inter-quartile range 5-9 days), and 60% were reported within one week after diagnosis. As in Sikhottabong Hospital, Dengue cases were reported with median eight days (inter-quartile range 5-27 days) after diagnosis in and 32% were reported within one week. Timeliness of case reporting was not evaluated in Hadxaifong Hospital because date of diagnosis was not collected. From April to June 2010, there were three reports of dengue outbreak investigation and rapid response was initiated within one day after reporting.

Table 1. Sensitivity, predictive value positive (PVP) and timeliness of dengue surveillance system in Vientiane Capital City, Lao People's Democratic Republic, 2009-2010

Attribute	Year	Mahosot Hospital	Hatxaifong Hospital	Sikhottabong Hospital
Sensitivity	2009	76%	23%	46%
	2010	57%	79%	96%
Predictive value positive (PVP)	2009	100%	100%	100%
	2010	100%	60%	100%
Median duration between diagnosis and report (inter-quartile range)	2009	7 days (5-9)	Not available	8 days (5-27)
Report within seven days after diagnosis	2009	60%	Not available	32%

Table 2. Villages with potential dengue outbreaks by data sources in Vientiane Capital City, June to July 2009

Data source	Mahosot Hospital	Sikhottabong Hospital	Hadxaifong Hospital
Hospital	Sengsavang	Sibounhuang*	Dongphuonhea
		Sibounhuangtha*	Thanaleng
		Thongpong*	
Surveillance	Sengsavang		Dongphuonhea
			Thanaleng
			Thamuoang

**Villages with potential outbreak that could have been detected by the surveillance system*

Discussion

In-depth studies of existing surveillance systems are keys to assure that high quality and most relevant information is available for policy setting and decision making, with the view of making corrections and adding innovations as needed. Our study on dengue surveillance system in VCC represented such an effort to assess the current conditions and make recommendations for future improvement of the system. The flows and methods of this system were simple and flexible. Although operating with limited personnel and budget, we observed supportive policies from all health authorities in VCC and WHO. We also observed satisfactory results of some quantitative attributes, including high sensitivity, and useful PVP and data quality. Surveillance data can be a useful tool for making policy on disease prevention and control, but efforts are needed to continue utilizing this valuable resource.

The sensitivity of case reporting in our study seems higher compared with reports from other studies which showed around 30-40% in both Thailand[10] and Indonesia[11]. The sensitivity in our study improved from 50% in June-July 2009 to 68% in June 2010. The emphasis on active surveillance may contribute to higher sensitivity.[12-15]

A comparison of active and passive surveillance system in Vermont demonstrated that active surveillance of physicians can improve reporting cases of hepatitis, measles, rubella and salmonellosis.[12] However, active surveillance requires much more labor and intensive human resources.[16] Given limited number of public health officers, once caseload increase, it would pose too much work burden for the Department of Health. Active surveillance may not be the most appropriate approach in such situation. Thus, it was not surprising to see lower sensitivity during June 2010 in Mahosot Hospital due to higher workload of data collection (128 cases in June-July 2009 versus 218 in June 2010).

Since thousands of dengue cases occurred in VCC during 2009, some outbreaks should have been expected. We found that 57% of outbreaks would have been detected if extensive analysis of surveillance data was performed; by which the surveillance system demonstrated its usefulness. However, since the public health officers were not very skillful in data management and analysis, no dengue outbreak was detected in the whole city of VCC. This was an aspect that should be improved for the system.

Since early detection of dengue cases and outbreaks is critical for prompt and effective responses, timeliness is an important attribute of the dengue surveillance system. The timeliness of case reporting from June to July 2009 was not adequate, especially in the district hospital. Routine weekly reporting of dengue cases is required according to the standard operating procedures for dengue outbreak.[17] The frequency is recommended to change to daily reporting when dengue outbreaks or large gatherings occur. Such a requirement and recommendation is consistent with the best practices of data reporting in dengue surveillance.[18] Delayed reporting is commonly seen. High workload of paper-based data collection and limited human resources might explain this phenomenon. Timeliness of reporting could be improved if an electronic reporting system is used.

Date of onset is required in almost all disease surveillance systems, which is a very important variable to describe the characteristics of dengue over time. Unfortunately, this variable was not collected for the routine dengue surveillance in VCC. The logbooks with limited information recorded were the single source for public health officers to collect the surveillance data, resulting in unavailability of some important data. It was not practical for public health officers to review each medical record since they have to collect data for 19 diseases in six central hospitals.

Limitations

Our study had some limitations. First, we identified dengue cases using clinical diagnosis rather than case definitions for surveillance in VCC due to limited information in the logbooks and incomplete medical records. However, the clinicians reported that they used the same case definition as that of the surveillance guideline for dengue diagnosis. It was therefore believed that our results were close to the actual values. Second, we did not further explore the characteristics of those under-reported cases because we had limited time for data collection in the field.

Recommendations

Our findings lead to several recommendations for future development of the dengue surveillance system. Firstly, capacity of data management and analysis should be enhanced for public health officers and epidemiologists so that they can utilize surveillance data for public health policy and action. Secondly, each central hospital needs an epidemiologist to be responsible for collecting and reporting surveillance data. Thirdly, date of onset should be routinely collected in order to monitor the epidemic, seasonal pattern and long-term trend.

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We also express our appreciation towards staff from the Department of Health in VCC, Mahosot Hospital, Hadxaifong Hospital and Sikhottabong Hospital for participating in interviews and assisting data collection. This study was funded by the "Strengthen Detection and Response Capacity for Infectious Disease in SouthEast Asia" Project by US Centers for Disease Control and Prevention.

Suggested Citation

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Analysis of Rabies Surveillance Data (2008-2011) in Bali Province, Indonesia

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Abstract

Bali Province was historically free from rabies. The first human rabies case in Bali was confirmed in late 2008. By June 2010, rabies had spread to all districts, affecting 30% of villages with 133 human deaths reported. To describe rabies situation in Bali from 2008 to 2011, data on human deaths and animal surveillance were collected from provincial public health and livestock offices of Bali, and Disease Investigation Centre (DIC) in Denpasar City, Bali. A total of 443 dogs were tested for rabies by the DIC Denpasar. Of these, 29% were tested positive by Fluorescent Antibody Test (FAT). The highest proportions of positive sample were from dogs that bit human and dogs with clinical signs of rabies. Male dogs were 1.7 times more likely to have rabies than the female ones and unvaccinated dogs were 2.2 times more likely to be infected with rabies than the vaccinated dogs. To control rabies in Bali, a multi-ministerial coordination mechanisms at national and local levels were established. Prevention and control measures were implemented, including mass dog vaccination, surveillance, stray dogs depopulation and public awareness campaign. Mass dog vaccination and stray dogs depopulation targeting dogs with history of biting humans or clinical symptoms demonstrated success in preventing spread of rabies in Bali.

Key words: rabies, dog, human, surveillance, Bali, Indonesia

Introduction

Rabies is a viral zoonosis of the central nervous system which is always fatal.[1] The disease is caused by Lyssavirus genus of the family Rhabdovirus and affects all mammalian species including humans.[2] The disease can be spread by rabid animals and dogs are the principal carriers for maintaining the infectious cycle of rabies. Contact of saliva with mucous membrane or wound can result in transmission of rabies. Similar to bites, scratches can also convey the infection.[3]

Rabies is one of the major public health concerns in many countries of Asia. The disease is endemic in Indonesia with 24 out of 33 provinces affected and approximately 150-300 people died of rabies every year.[4] In West Java, the first rabid case was reported in buffalo during 1884, in dog during 1889 and in human during 1894.[5] Rabies is one of the diseases that became a national priority.

Although Bali was historically free from rabies, the first animal and human rabies cases were confirmed in Badung District in late 2008.[6] Since then, the disease spread rapidly, reaching its peak and affecting all districts in June 2010. To control rabies in Bali, multi-ministerial coordination mechanisms were established at national and local levels. Prevention and control measures have been implemented, including mass dog vaccination, surveillance, stray dogs depopulation and public awareness. Although rabies was spreading throughout Bali, information related to rabies situation in the province was limited since there was no common disease information platform to capture both animal and human rabies cases. Therefore, aims of this study were to describe rabies situation in Bali using data available from provincial public health and livestock offices of Bali and Disease Investigation Centre of Denpasar, and discuss on the effectiveness of current preventive and control measures.

Methods

Bali province has an area of 5,632 km^2 and 592 km coastline. Administratively, the province has nine districts, including Jembrana, Tabanan, Badung, Gianyar, Karangasem, Klungkung, Bangli, Buleleng

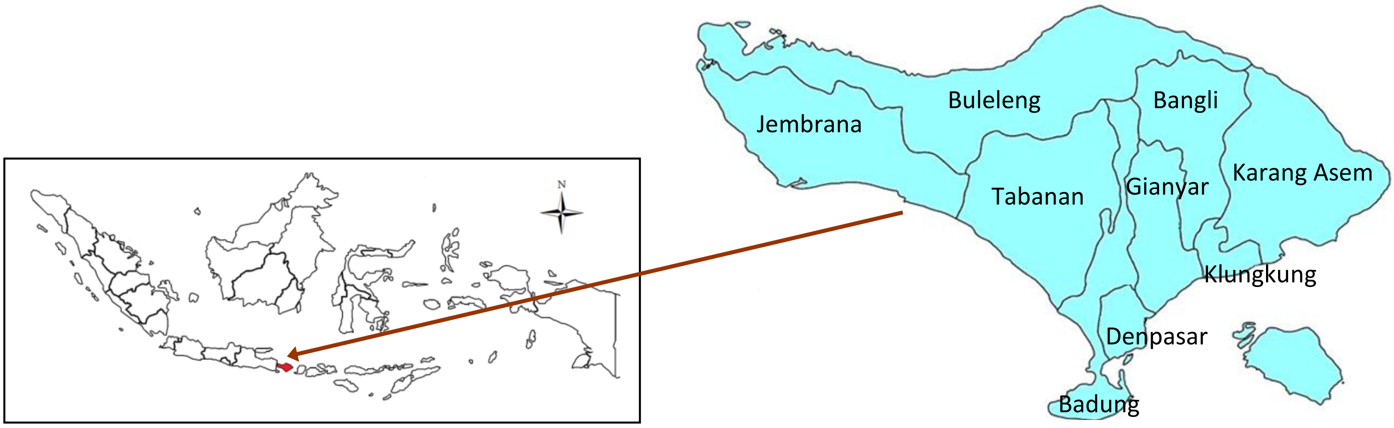

Figure 1. Map of Bali Province with districts, Indonesia

and Denpasar City, the capital city of the province (Figure 1). The human population of Bali Province was 3,891,428[7], with a population growth rate of 2.5 percent per year.

Data Collection, Management and Analysis

Table 1. Type of data collected from different sources in Bali Province, Indonesia, 2008-2011

Source	Data	Period
Disease Investigation Center (DIC), Denpasar	Number of affected village Samples from dogs	Nov 2008 to Nov 2011 Sep 2010 to Nov 2011
Provincial Public Health Office	Number of human rabies cases Number of human cases bitten	Nov 2008 to Nov 2011
Provincial Livestock Office	Mass vaccination	May to Nov 2011

Information on human and animal rabies was provided by the Provincial Public Health Office, Provincial Livestock Office and Disease Investigation Centre (DIC) in Denpasar (Table 1).

Data were entered and managed in spread sheet, and quality and validity were assessed. Data analysis, both descriptive and analytical methods, were conducted using Epi Info 3.5.3[8]. Association between gender and vaccination status was calculated using odd ratios with 95% confidence intervals. Cases were defined as the animal samples tested positive for rabies by Fluorescent Antibody Test (FAT). Geographic information system (GIS) was used to describe spatial patterns and spread of rabies in Bali Province.

Results

Rabies in Animal

Results of laboratory analysis from DIC in Denpasar showed that number of villages affected increased gradually from 1% (5 of 723) in 2008 to 30% (216 of 723) in 2010 before it went down to 9% (62 of 723) in the following year. Locations and proportions of infected villages from November 2008 to November 2011 were illustrated in figure 2.

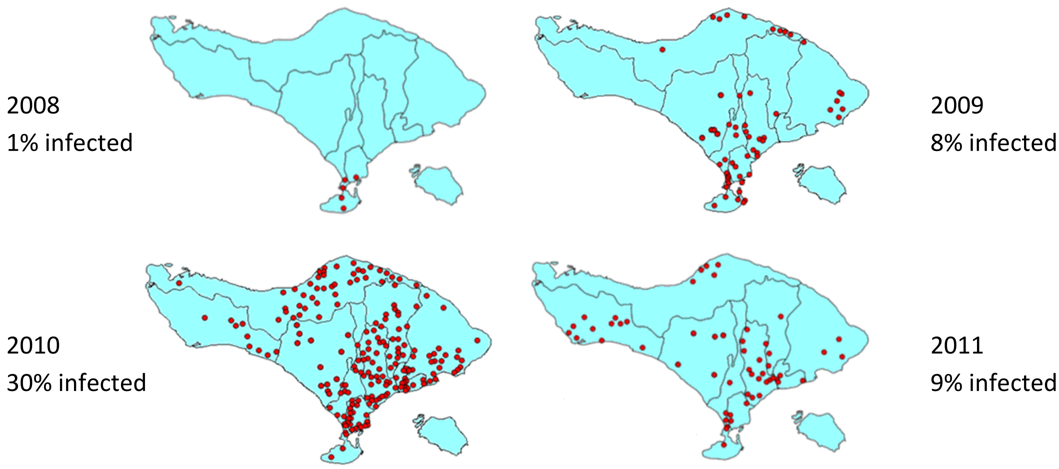

Figure 2. Geographical distribution of rabies infected villages in Bali Province, Indonesia, November 2008 to November 2011

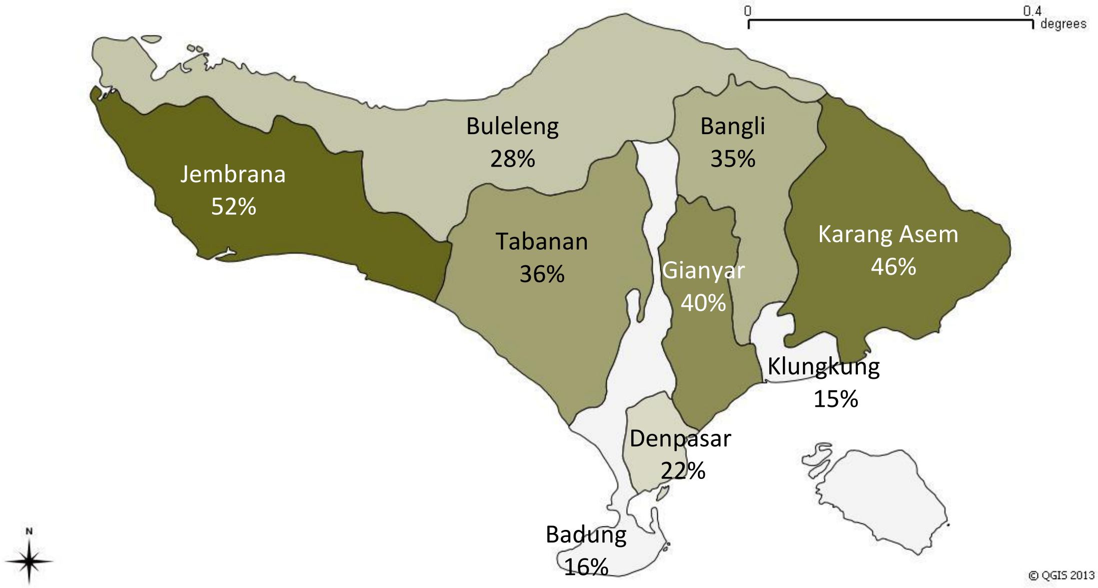

Figure 3. Spatial distribution of positive samples of dog rabies by district in Bali Province, Indonesia, September 2010 to November 2011

There were a total of 433 samples submitted and tested by DIC from September 2010 to November 2011. Of these, 128 (29%) samples were tested positive for rabies, with the highest in Jembrana District (52%) and lowest in Klungkung District (15%) (Figure 3). Most of positive samples were from dogs that had history of biting people and dogs with clinical signs of rabies with 47% and 36% respectively. None out of 86 samples submitted during stray dog depopulation from January to November 2011 was tested positive for rabies.

Although there was no statistical significance, male dogs were 1.7 times more likely to be tested positive for rabies than the female ones and unvaccinated dogs were 2.2 times more likely to be positive for rabies than vaccinated dogs (Table 2).

The second dog mass vaccination program since May to November 2011 in Bali Province covered 83% of the total dog population.

Rabies in Human

Total number of reported human deaths of rabies in Bali Province from 2008 to September 2011 was 133. The highest number of reported human deaths (82) was in 2010, with incidence proportion of 2.1 per 100,000 population. The number of rabid human deaths reduced to 19 in all districts during 2011, except in Klungkung and Bangli Districts where the number of human deaths were not reduced (Table 3).

Although number of reported human rabies deaths reduced over the time, number of human cases bitten by dogs remained unchanged, with over 4,000 reported cases per month (Figure 4).

Table 2. Positive samples of dog rabies by gender and vaccination status in Disease Investigation Centre (DIC), Bali Province, Indonesia, January to November 2011

Variable	Category	Sample positive	OR (95% CI)
Gender	Male	30% (53/175)	1.7 (1.0-2.9)
	Female	21% (23/111)	
Vaccination status	Unvaccinated	37% (40/109)	2.2 (0.9-5.0)
	Vaccinated	21% (11/52)	

Discussion

The results from this study revealed that rabies has spread to all districts in Bali since it was first introduced to the island in late 2008 and reached the highest rate in 2010. Since then, the number of affected villages, human deaths and rabid dogs reduced gradually, reflecting success of dog mass vaccination program conducted in late 2010 and in 2011. Over 70% of dog population in the province were vaccinated after the vaccination programs. The impacts of effective vaccination program rely heavily on well planned vaccination and good communication strategies. However, vaccinated animals may not have long-lasting protection with low quality of vaccine, poor health condition and a single dose of rabies vaccine.[10] This reflects the finding in this study where dogs that had vaccination history against rabies were tested positive for rabies.

Male dogs were more likely to be infected with rabies than the female ones, which might be important for the spread of rabies in Bali. The behavior of males

Table 3. Temporal distribution of human rabies deaths in districts of Bali Province, Indonesia, 1 Jan 2008 to 22 Sep 2011[9]

District	Number of human death				Total
	2008	2009	2010	2011	
Buleleng	0	0	21	5	26
Jembrana	0	0	0	0	0
Tabanan	0	13	5	0	18
Badung	4	6	10	1	21
Denpasar	0	3	6	2	11
Gianyar	0	1	5	1	7
Klungkung	0	0	4	4	8
Bangli	0	0	2	4	6
Karangasem	0	5	29	2	36
Total	**4**	**28**	**82**	**19**	**133**

that move around greater distance to find females as their mating behavior increase risk for coming into contact with rabid animals than the females. This finding is in agreement with Panichabhongse[11] that two-thirds of the positive cases were male dogs. Wandeler, et al also reported that male dogs left their referral household significantly more often and covered greater distances.[12]

High proportion of positive samples from dogs that bite humans and dogs with clinical signs of rabies can be used to convince communities to report any incident in accordance with this finding to the relevant authorities. Depopulation measure should be targeted on the dogs which are involved in unprovoked dog bites or dogs showing clinical signs of rabies.

Although number of human deaths from 2010 to 2011 decreased, numbers of reported human cases bitten by dogs remained stable, with over 4,000 cases per month. Therefore, human are still at risk of getting rabies if dogs are infected. Increase public knowledge about rabies, awareness to seek medical treatment and to report after being bitten by animals, and availability of human post-exposure prophylaxis may contribute to reduction of human deaths and bitten cases.

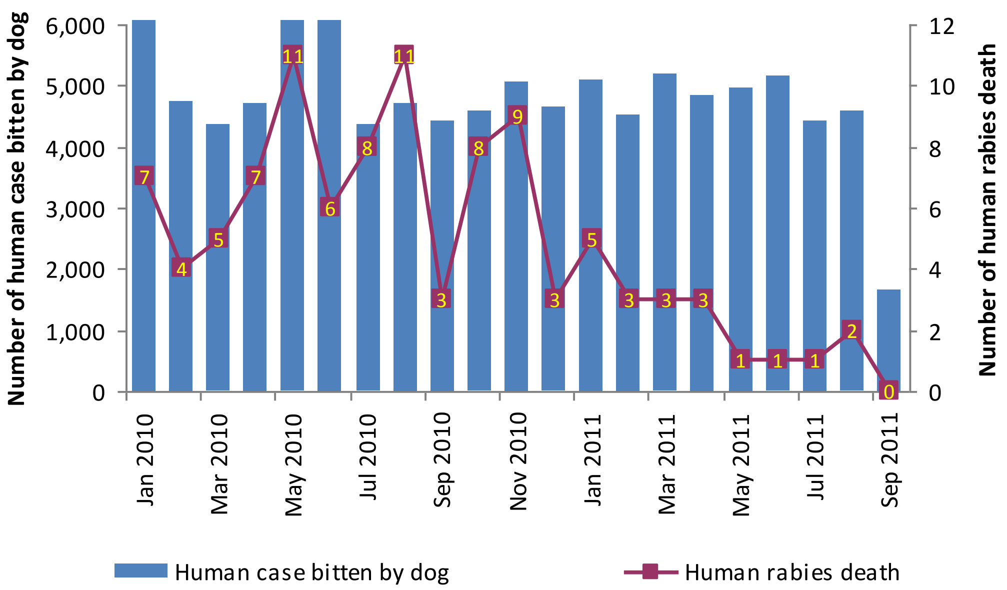

Figure 4. Temporal distribution of number of human cases bitten by dog and human rabies deaths by month in Bali Province, Indonesia, January 2010 to September 2011

Public Health Actions and Recommendations

Collaboration between human health and animal health sectors to improve public knowledge and awareness about rabies through public counseling at sub-village level, high level of commitment to provide human post-exposure prophylaxis and establishment of rabies center to facilitate reporting and disseminating information to the public are key factors to prevent human and dog rabies.

The interpretation of rabies situation in Bali was based on available data, which provided good representation of rabies situation in Bali. Improvement on data recording and continuous analysis of surveillance data both in human and animal sectors are essential to understand the rabies situation and allow meaningful evaluation of the prevention and control program as well. Mass dog vaccination and targeted depopulation of stray dogs with bite history or clinical symptoms demonstrated good way in preventing the spread of rabies.

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Prevalence of HIV in Leprosy Patients in Central Myanmar during 2008

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Abstract

HIV infection has been shown to be strongly associated with the development of active tuberculosis. However, its association with leprosy was much less clear. Moreover, seroprevalence of HIV infection among leprosy patients has never been reported in Myanmar. This study aimed to determine the seroprevalence of HIV among leprosy patients and the association between HIV infection and types of leprosy in central Myanmar during 2008. A total of 299 leprosy patients, including 242 multibacillary (MB) and 57 paucibacillary (PB) leprosy patients, were enrolled. The overall HIV seroprevalence was 3.7%, with 4.1% in MB leprosy patients and 1.8% in PB leprosy patients. Fifty MB leprosy patients (20.7%) had history of multi-drug therapy (MDT) and 4 of them (8.0%) were HIV infected. Six out of 192 MB leprosy patients without history of MDT were HIV infected (3.1%). MB leprosy cases with history of previous treatment had greater prevalence of HIV infection. Further study should be considered whether HIV infection may cause difficulty to cure leprosy and additional MDT course may require in HIV infected leprosy patients with previous history of MDT.

Key words: HIV, leprosy, coinfection, Myanmar

Introduction

In January 2003, leprosy had been eliminated in Myanmar as the prevalence rate reduced below one case per 10,000 population.[1] However, during 2011, 3,082 new cases with 18 relapse cases were reported. Almost all paucibacillary (PB) leprosy patients (94%) and multibacillary (MB) leprosy patients (94%) were cured.[2] Sustainability of leprosy elimination is mandatory after achieving the goal.

Leprosy is classified as paucibacillary or multibacillary according to its infectious form. Patients with PB leprosy and HIV may progress to MB leprosy.[5] The HIV infected leprosy patients are more likely to manifest advanced stages of leprosy than HIV uninfected patients.[6] In addition, HIV infection may be associated with increased frequency of relapse in leprosy.[7]

Although HIV infection was shown to be strongly associated with the development of active tuberculosis and diseases caused by other mycobacteria, its association with leprosy was much less clear.[3] Vinay et al reported in 2009 that the incidence of leprosy in patients receiving anti-retroviral treatment was 5.2 per 1,000 person-years.[4] As this was much higher than the incidence of leprosy in general population, the authors suggested regular examination of leprosy in HIV infected individuals.[4] In addition, seroprevalence of HIV infection among leprosy cases was still unclear in Myanmar.

Hence, it is essential to detect HIV infection in areas where leprosy is prevalent for better understanding of risk of mycobacterial diseases and better care of leprosy patient with HIV. Early detection of HIV coinfection in leprosy patients may be valuable in sustaining of leprosy elimination.

This study aimed to determine the HIV seropositivity among registered leprosy patients and identify the association between HIV infection and types of leprosy in 10 townships of central Myanmar in 2008. According to the National Statistics of Leprosy Control Program, leprosy hot spot areas were in the central Myanmar.

Method

On individual assigned date during the period from January to December 2008, 179 registered leprosy patients were invited to the nearest rural health centers (RHCs) in 10 townships of central Myanmar and their consent was obtained to participate in the study. As some patients could not come to RHCs, research teams visited their houses to obtain their consent. Moreover, additional 120 registered leprosy patients were requested to participate in the study when they visited Mandalay Special Skin Clinic for follow-up and monthly multi-drug therapy (MDT). All registered leprosy patients currently taking MDT in the study townships were included. The study protocol was approved by the "Ethical Committee on Medical Research Involving Human Subjects" from Department of Medical Research (Central Myanmar).

Among total 299 leprosy patients participated in this study, 35 were under 18 years old. Thus, legal guardians of 35 patients and 264 eligible patients were informed about the research study and their consent was obtained. HIV pretest counseling and data collection using semi-structured questionnaire were conducted by trained interviewers. From each patient, 2 ml of venous blood and at least two slit skin smears were collected by local health workers. Personal identification was kept confidential and samples were coded as well.

Slit skin smears were immediately heat fixed and stained using modified Ziehl Neelsen stain. Then, microscopic examination was carried out by a microbiologist and two trained technicians independently[8] in Department of Medical Research (Central Myanmar).

Venous blood samples were maintained at 2-8°C, and sera were separated and stored temporarily at clinical laboratories of the nearest district hospitals, which were then transported to bacteriology research unit of Department of Medical Research (Central Myanmar). The samples were tested for HIV using ELISA (Microlisa HIV kit from J. Mitra & Co. Pvt. Ltd, India) and the positive samples were confirmed by Western Blot test (LAV Blot 1 test kit from Bio-Rad).

Descriptive analysis of socio-demographic information, type of leprosy, risk behavior and results of HIV test were conducted using SPSS version 16.0. Fisher exact test was employed to determine the association between HIV seropositivity rate and type of leprosy.

Results

Of total 299 leprosy patients participated in this study, there were more MB leprosy patients (80.9%) than PB leprosy patients (19.1%) (Figure 1) and male to female ratio was 1.6:1. Although 55 patients had history of previous MDT treatment for leprosy, they seemed to be defaulters because they did not answer whether the medication was completed or not. A total of 11 patients were confirmed to have HIV infection which included 10 MB cases and one PB cases.

Median age of MB patients was higher than PB patients, however was not statistically significantly. Moreover, gender was not different between both types of leprosy either. Number of patients taking steroid treatment for lepra reaction was significantly prominent in MB patients. More MB patients had positive result of slit skin smear compared with PB patients. Risk behaviors for HIV infection and seropositivity rate were not significantly different between both groups (Table 1).

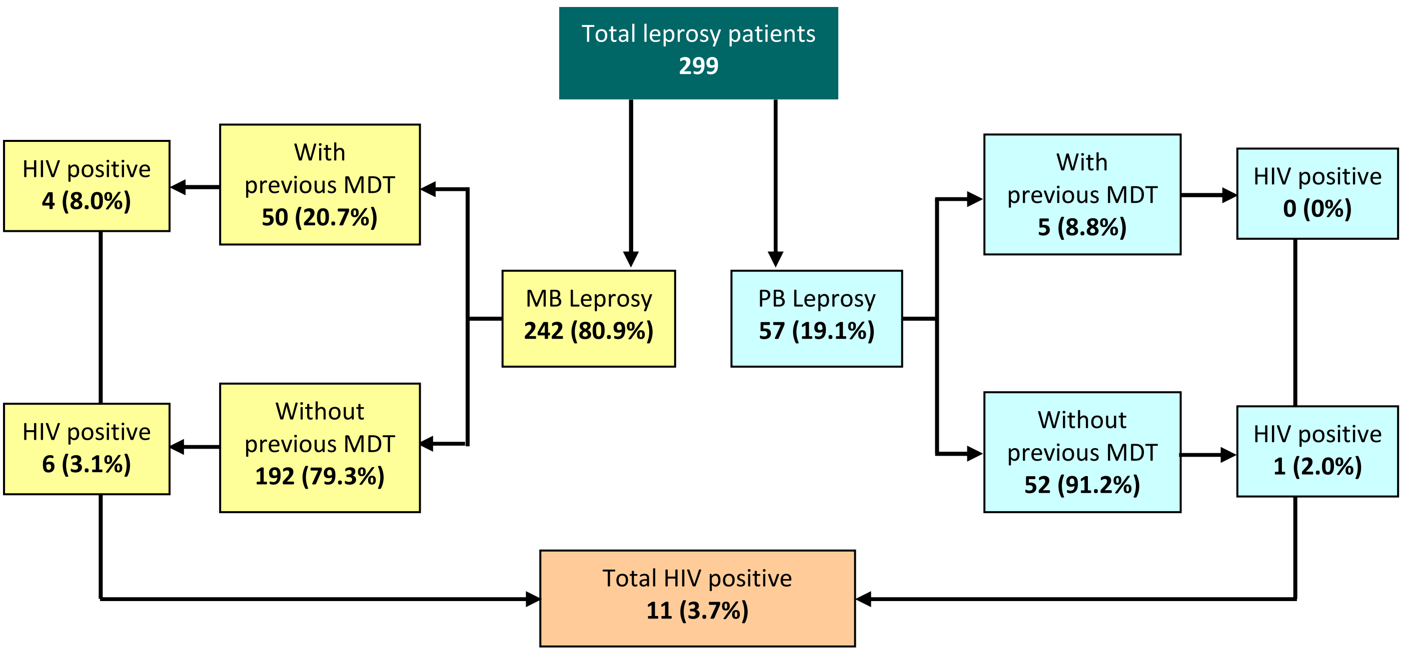

Figure 1. Multibacillary (MB) and paucibacillary (PB) leprosy patients and HIV infection in central Myanmar, 2008

Table 1. Epidemiological and clinical characteristics of leprosy patients in central Myanmar, 2008 (n=299)

Characteristic	Type of Leprosy[1]				P-value
	Multibacillary (MB) leprosy (n=242)		Paucibacillary (PB) leprosy (n=57)		
	Number	Percent	Number	Percent	
Median age (Range)	35.29 years (1-77)		31.84 years (3-76)		0.058
Male gender	155	64.0	29	51.0	0.071
Residency in rural area	133	55.0	33	58.0	0.768
Underlying medical conditions					
Diabetes	2	0.8	1	1.8	-
TB	3	1.2	1	1.8	-
Asthma	13	5.4	4	7.0	-
Taking steroid for lepra reaction	81 (n=236)	34.0	9 (n=55)	16.0	**0.019**
BCG scar	64	26.0	17	30.0	0.621
Risk behavior for HIV infection					
History of blood transmission	25	10.0	7	12.0	0.638
History of IDU[2]	29	12.0	6	10.0	0.845
History of STD[3]	14 (n=240)	6.0	1	1.8	0.353
History of partner's STD	4 (n=181)	2.0	0 (n=39)	0.0	0.408
Contact with CSW[4]	17 (n=125)	14.0	3 (n=24)	12.5	0.427
History of homosexual	10 (n=125)	13.0	1 (n=24)	4.0	0.344
History of multiple partners	21 (n=125)	17.0	2 (n=24)	8.0	0.247
Slit skin smear positive	104	43.0	5	9.0	**<0.001**
HIV positive	10	4.0	1	1.7	0.697

[1] *Variables with denominators less than the total number were indicated.*

[2] *IDU - Injection drug user*

[3] *STD - Sexually transmitted diseases*

[4] *CSW - Commercial sex worker*

Although median age of HIV infected patients was higher than that of the uninfected patients, result was not statistically significant. More male leprosy patients had HIV infection apparently than female patients. HIV infected leprosy patients had received previous multi-drug treatment (MDT) more than HIV uninfected leprosy patient. Risk behaviors, slit skin smear result and previous MDT treatment were not statistically significant between HIV infected and uninfected leprosy patients (Table 2).

Discussion

Myanmar reported 3,082 new cases of leprosy in 2011.[1] Among them, MB leprosy accounted for 70% and 35% was female.[9] This study was carried out in communities as well as a specialist clinic. Enrollment of participants was prominent numbers in MB cases and male patients.

This study revealed that median age of all participants was 34 and was not significantly different between MB and PB groups. However, Moet et al reported a bimodal distribution of leprosy by age that the risk increased for those 5-15 years of age, reached a peak for 15-20 years, decreased for 20-29 years and gradually increased again after a 30-year lag.[10] Other studies had shown that the risk of leprosy among contacts was significantly higher for those younger than 14 years, particularly for contacts of MB patients.[11]

Among new leprosy patients, Myanmar National Leprosy Control Program detected 20 relapse patients in 2008 and 18 in 2011.[1,9] Although high number of patient with previous MDT was observed in this study, there were two things to consider. First, their medication might not complete. Second, symptoms of reaction and symptoms of relapse could be confusing.

Table 2. Distribution of risk behaviors among leprosy patient and HIV infection in central Myanmar, 2008

Characteristic	HIV infected patient (n=11)		HIV uninfected patient (n=288)	
	Number	Percent	Number	Percent
Median age (range) (n=268)	43 years (20-74)		30 years (1-77)	
Male gender	9	81.8	159	55.2
Residency in rural area	7	63.6	159	55.2
Type of leprosy				
PB	1	9.1	56	19.4
MB	10	90.9	232	80.5
Slit skin smear positive	3	27.3	106	36.8
With previous MDT	4	36.4	51	17.7
Risk factor among adult (age >14 years)	(n=11)		(n=257)	
History of blood transfusion	2	18.2	30	11.7
History of IDU	1	9.1	31	12.1
History of STD	0	0	15	5.8
STD in partner	0	0	4 (n=200)	2.0
Risk factor among male	(n=9)		(n=164)	
Sex with CSW	1	11.1	17	10.4
History of homosexual	0	0	9	5.5
Multiple partner	0	0	21	12.8

A patient may develop nerve damage and reactions even more than three years after completing MDT. Specialist opinion is often required to differentiate whether they are really experiencing a reaction, but not relapse of leprosy.[12]

HIV seropositivity of leprosy patient in this study was 3.7% which was much higher than that of general population (0.5%) reported by Myanmar National AIDS Program (NAP).[13] Moses et al reported in 2003 that HIV infection was more prevalent among leprosy patients than blood donors in Nigeria.[14] Alternatively, another study reported in 2009 that the incidence of leprosy in patients receiving anti-retroviral treatment was much higher than that of the general population.[4] HIV seroprevalence in leprosy patients ranged from 0.3% to 33.3% in studies conducted in India, Brazil and African countries.[7]

High proportion of Injection Drug Users (IDU) history among leprosy patients was noticed while prevalence of IDU among 15-64 years old expressed 0.2% in 2007.[15] HIV sentinel surveillance (HSS) by Myanmar NAP reported that median of HIV prevalence among IDU was 20.3% (range 11.0-32.5%)[13] and this group among leprosy patients may need to be observed.

In this study, HIV infection was not shown to be associated with the type of leprosy. It was premature to conclude that leprosy was the risk for developing advanced stage of HIV and vice versa. Pereira et al in 2004 and Sarno et al in 2011 concluded that antiretroviral therapy (ART) and immune reconstitution were critical factors driving the development and/or clinical appearance of leprosy lesions.[16,17] On the contrary, another study in 2005 showed that neither leprosy or HIV infection precipitated the other.[18] As ART coverage among Myanmar people reached 24% in 2010[19] and has been increasing, a study on coinfection of leprosy and HIV with or without ART should be considered in order to understand more on the two diseases of the most stigmatic.

Limitations

Information on risk behaviors was not available from children less than 14 years. Similarly, female patients were not assessed for extramarital sexual behaviors.

Public Health Actions and Recommendations

The authors recommended that as the number of HIV patients was small, further coinfection study on leprosy and HIV should be considered. Information on HIV risk factors is limited in this study. Thus, higher number of leprosy patient is required to obtain more information on risk factors and nationwide scale-up study should be considered. Permanent or mobile specialist skin clinics should be provided in leprosy pocket areas to differentiate between reaction and relapse among treated leprosy patients, especially patients with HIV infections.

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