J Vect Borne Dis 43, June 2006, pp. 73–76

An observation on correlation between rainfall and the prevalence of clinical cases of dengue in Thailand

Viroj Wiwanitkit

Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Abstract

Background & objectives: An investigation was carried out in Thailand to study the correlation between rainfall and prevalence of dengue infection during 2002–03, which can be used for prevention and control of the disease.

Methods: Rainfall data (2002–03) collected from Ministry of Public Health were utilised for transformation of the infection and the rainfall data were derived from Royal Irrigation Department, Thailand. The correlation between the rainfall and the prevalence of dengue was assessed by regression analysis.

Results: The least square equation plot prevalence (y) versus rainfall (x) is $y = 3.0x + 4.6$ ($r = 0.78$, $p < 0.05$) ($r = 0.68$, $p < 0.05$).

Interpretation & conclusion: The study indicated that the prevalence of dengue infection in Thailand may depend on rainfall. Therefore, the surveillance and control of mosquito should be intensified during the period with high rainfall is recommended. However, the other confounding factors like ambient temperature and humidity which also determine the transmission of dengue should be looked into, before concluding that the increased prevalence is a result of rainfall alone. Further, similar studies to assess the correlation between the rainfall and prevalence of infection in the other countries are required to confirm these observations.

Key words Correlation – dengue – rainfall – Thailand

Introduction

Dengue is an important potentially deadly mosquito-borne disease in the tropical countries, affecting general population in the southeast Asia Region including Thailand[1]. Despite decades of control success and a competent network of country-wide health infrastructure, dengue still remains an important health threat in rural Thailand[2]. *Aedes aegypti* (Diptera: Culicidae) considered to be primary dengue vector, is also common in the country[3].

The human infection with this virus is common in Thailand. The surveys of the disease prevalence are useful for prevention and control of disease[1-3] and have been regularly carried out in Thailand. Recently, Goncalves Neto and Rebelo[4] reported a positive correlation with the amount of rainfall and relative humidity. Here, the correlation between the rainfall and the prevalence of clinical cases of dengue in Thailand was investigated.

Material & Methods

Data of the dengue distribution in Thailand: The data of the overall infection rate of dengue distribution in Thailand were derived from the reported registry data on dengue of Ministry of Public Health (www.epid.moph.go.th). Dengue prevalence data of 76 provinces in Thailand during year 2002–03, giving sample size equal to 152, were used. These data were utilised in the transformation of the infection rate into the prevalence (1/1,000,000 population).

Data of the rainfall distribution in Thailand: The data of the rainfall (inch) in Thailand were obtained from the Royal Irrigation Department, Thailand. These data were utilised in the transformation of the geographical data into the rainfall corresponding to each province; reported quantity of rainfall in rich was assigned to each corresponding province. Average yearly rainfall distribution images of Thailand were presented as the GIS picture (created by High Performance Computing Centre/NECTEC, Thailand).

Correlation study between the rainfall and the prevalence of dengue infection: First, the two main data, geographical data and the overall infection rate of dengue, were extracted. The geographical data were transformed into the rainfall according to the rainfall distribution in Thailand as previously mentioned and presented as millimeters. The overall infection rate of dengue were transformed into the prevalence and presented as percentage. The correlation between the rainfall and the prevalence of dengue was assessed by regression analysis. The least square equation plot prevalence (y) versus rainfall (x) and the correlation coefficient (r) were calculated. All statistical analyses were performed using SPSS 10.0 for Windows.

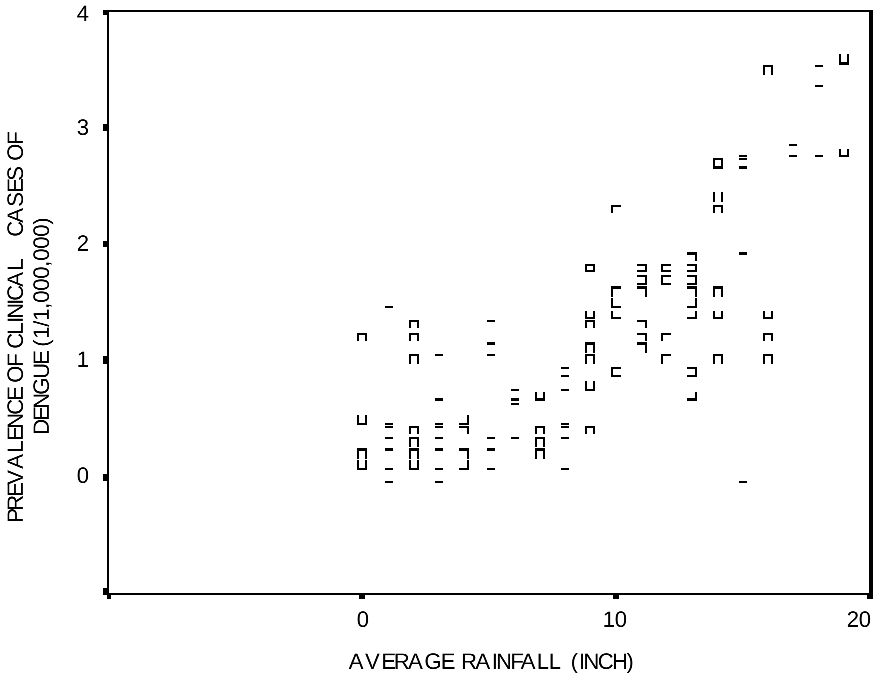

Fig. 1: Scatterplot showing prevalence of dengue/1,000,000 population and average rainfall in Thailand

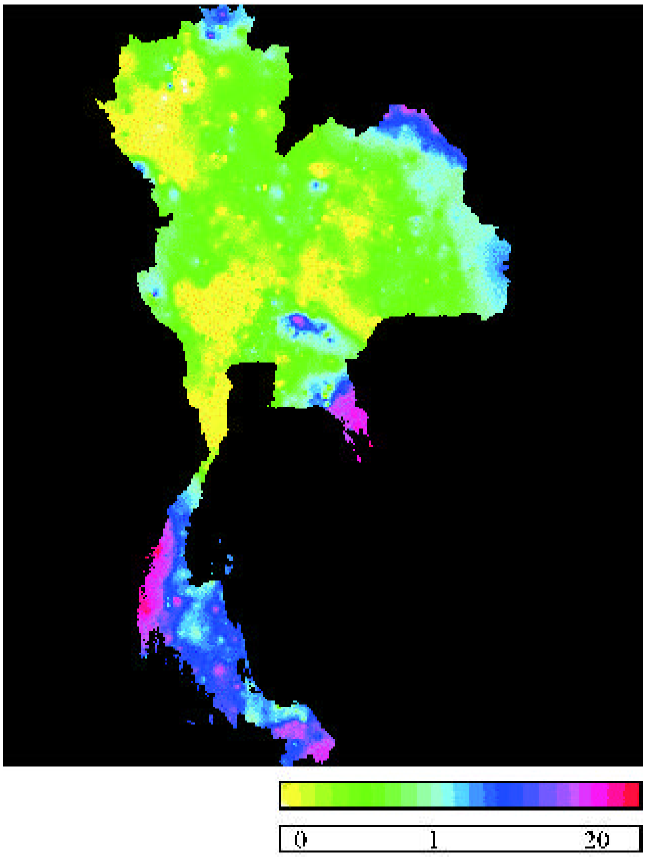

Fig. 2: Predicted prevalence of dengue infection. (This figure is adapted from the Fig. 1 based on the results of the present study. The least square equation plot rainfall (y) versus prevalence (x) is y = 36.4x + 864.6)

Results & Discussion

The relation between the transformed rainfall and the prevalence of dengue was evaluated. The details of dengue prevalence and the average rainfall are presented in Fig. 1. In this study, the least square equation plot prevalence (y) versus rainfall (x) is $y = 3.0x + 4.6$ ($r = 0.78$, $p < 0.05$). The predicted prevalence of dengue based on the rainfall distribution in Thailand is shown in Fig. 2.

Dengue is the most important mosquito-borne viral infectious disease of people. Each year estimated 50–100 million cases of dengue fever and about 250,000–500,000 cases of dengue hemorrhagic fever occur world-wide[5,6]. Presently, the Southeast Asia including Thailand, is still endemic for dengue[1,2]. In Thailand, this disease is still prevalent in some distant area[1,2]. Because of its dependence on human/vector (mosquito) contact, dengue is considered to be a disease associated with poverty[7]. Underprivileged people in the rural endemic area become infected with dengue. Also it causes economical loss and affect the social functions. The monitoring of the incidence of the disease provides a useful data for disease surveillance and control[1-3].

The effect of rainfall on dengue prevalence is a very important study because of the need of tools to forecast variations in incidence and the risk related to the impact of change in climate. In the present investigation this correlation has been studied indirectly by transformation of the geographical data into the rainfall and infective rate into the prevalence and a significant association has been observed. In addition, the high prevalence of dengue infection is also marked at the border area between Thai and nearby countries (Fig. 1). This study can confirm the possible influence of rainfall on the prevalence of dengue[4, 5]. Indeed, there was a recent previous report on the seasonal variation on the dengue prevalence in Thailand, which indicated the peak prevalence when the rainfall was very high[8].

Correlation of rainfall, temperature, humidity with dengue transmission is well established. Indaratna *et al*[8] recently reported that the concentration of malaria as well as dengue along international border areas underscored the desirability of multi-country coordination of disease management and control programmes[8]. Thammapalo *et al*[9] reported that dengue incidence was negatively associated with rainfall. Considering the data from Latin American countries, Goncalves Neto and Rebelo[4] found a positive correlation between disease and amount of rainfall. For Thailand, although there are some observations of the correlation between prevalence of dengue and rainfall, those studies based on some regions and the results from overall regions of the countries has never been accessed. This study manipulated on the data from all regions of Thailand

and additional prediction map for prevalence of clinical cases of dengue based on the rainfall has been prepared.

In conclusion, the prevalence of dengue infection in Thailand may depend on rainfall. Therefore, intensification of surveillance and control of mosquitoes during the period with high rainfall is recommended. However, it should be taken into account other confounding factors, which also determine the transmission of dengue, including other seasonal factors like ambient temperature and humidity since these factors will become favourable with rainfall. In addition, since asymptomatic and mildly symptomatic cases are preceded before clinical cases appear, this report can show only the correlation between rainfall and the prevalence of clinical cases of dengue in Thailand. Further, similar study to assess the correlation between the rainfall and prevalence of infection in the other countries is required to fulfill the conclusion. In addition, the questions are more on the quantification of that effect and on the relationship with the emergence of outbreaks and on the impact of climate changes.

•

References

1. Thisyakorn U, Thisyakorn C. Diseases cuased by arboviruses-dengue hemorrhagic fever and Japanese B encephalitits. *Med J Aus* 1994; *160*: 22–6.
2. Udomsakdi S. Studies on hemorrhagic fever in Thailand 1958–1971: a review. *J Med Assoc Thai* 1973; *56*: 40–66.
3. Gratz NG. Lessons of *Aedes aegypti* control in Thailand. *Med Vet Entomol* 1993; *7*: 1–10.
4. Goncalves Neto VS, Rebelo JM. Epidemiological characteristics of dengue in the Municipality of Sao Luis, Maranhao, Brazil 1997–2002. *Cad Saude Publica* 2004; *20*: 1424–31.
5. Guzman MG, Kouri G. Dengue and dengue haemorrhagic fever in the Americas: lessons and challenges. *J Clin Virol* 2003; *27*: 1–13.
6. Guzman MG, Kouri G. Dengue: an update. *Lancet Infect Dis* 2002; *2*: 33–42.
7. Gupta I, Mitra A. Basic amenities and health in urban India. *Natl Med J India* 2002; *15* (Suppl 1): 26–31.
8. Indaratna K, Hutubessy R, Chupraphawan S, Sukapurana C, Tao J, Chunsutthiwat S, Thimasarn K, Crissman L. Application of geographical information systems to co-analysis of disease and economic resources: dengue and malaria in Thailand. *Southeast Asian J Trop Med Pub Hlth* 1998; *29*: 669–84.
9. Thammapalo S, Chongsuwiwatwong V, McNeil D, Geater A. The climatic factors influencing the occurrence of dengue haemorrhagic fever in Thailand. *Southeast Asian J Trop Med Pub Hlth* 2005; *36*: 191–6.

Corresponding author: Dr. Viroj Wiwanitkit, Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.
e-mail: wviroj@yahoo.com

Received: 06 February 2006 *Accepted in revised version:* 26 April 2006