

PROSPECTIVE STUDY OF DENGUE IN BANGKOK DURING 2015-2016

Wongwat Liulak¹, Peerapong Saichaer², Woraman Waidab³, Apatcha Pungjitprapai³, Sanguansak Buranakitsin⁴, Bunchoo Suntorn-opas⁴, Supanee Utensute⁵, Anop Lekhakul⁵, Namwan Kittikool⁶, Ekasitt Wanitcharoenkul⁶, Thitikarn Laohasurayotin⁷, Parinya Potidang⁷, Wanida Wonglak¹, Methipot Chatameteekul¹ and Usa Thisyakorn⁸

¹Department of Health, Bangkok Metropolitan; ²Bangkok Metropolitan; ³Charoenkrung Pracharak Hospital; ⁴Klang Hospital; ⁵Wetchakarunrasm Hospital; ⁶Sirindhorn Hospital; ⁷Lat Krabang Hospital; ⁸Department of Pediatrics, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.

Abstract. Dengue patients admitted to 5 hospitals of the Department of Medical Service, Bangkok Metropolitan, Bangkok, Thailand during 2015-2016 were prospectively studied. The diagnoses of all dengue patients were adhered to clinical and laboratory criteria for the diagnosis of dengue patients as established by the WHO 1997. Blood for dengue serotype detection was collected from all patients. The disease was seen all year round with higher incidence during the rainy season. Dengue patients were seen in all age groups with increase in the number of cases in adolescents and adults. All four dengue serotypes were detected during the period of study with the following descending order: 45% DEN-4, 29% DEN-3, 17% DEN-2, 8% DEN-1 and 1% combined serotypes. Infections with any of all 4 dengue serotypes were seen in all age groups. All severity of dengue diseases can be seen in all age groups who were infected with any of dengue serotypes. The study showed that all four dengue serotypes circulated in Bangkok from 2015-2016 with DEN-4 as the predominant serotype.

Keywords: dengue, epidemiology, serotype, severity

INTRODUCTION

Dengue, a global health threat is the most common mosquito-borne viral infection transmitted by *Aedes* mosquitoes. There are four antigenically distinct, closely related serotypes of dengue virus (DEN1-4) which belong to genus *Flavivirus* in the family *Flaviviridae*. A continuum of dengue disease includes undifferentiated febrile illness (UFI), dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) (Thisyakorn and Thisyakorn, 2015).

The World Health Organization's (WHO's) Global Strategy for Dengue Prevention and Control

Correspondence: Usa Thisyakorn, MD, Department of Pediatrics, Faculty of Medicine, Chulalongkorn University, 1873 Rama IV Road, Bangkok 10330, Thailand.
E-mail: fmeduty@mail.md.chula.ac.th

(2012-2020) aims to reduce the burden of dengue through the following objectives: reduce dengue mortality by 50% and reduce dengue morbidity by 25% by 2020 and estimate the true burden of disease by 2015. The global strategy is based on five technical elements of: diagnosis and case management; integrated surveillance and outbreak preparedness; sustainable vector control; vaccine implementation; and basic operational and implementation research. Five enabling factors support the technical elements: advocacy and resource mobilization; partnership; coordination and collaboration; communication to achieve behavioral outcomes; capacity building; and monitoring and evaluation (WHO, 2012).

Integrated surveillance is important for risk assessment and situation awareness, and can support outbreak preparedness and development of appropriate public communication. However,

the focus must be on feasibility as resources are often limited at the national level. The combination of surveillance techniques employed at a national level must be prioritized while ensuring that surveillance can be sustained and dengue disease identified early for a locally appropriate response.

The objective of this study is to identify infecting dengue serotype in all dengue patients admitted to 5 hospitals of the Department of Medical Service, Bangkok Metropolitan, Bangkok, Thailand during 2015-2016.

MATERIALS AND METHODS

A prospective study was conducted with all dengue patients admitted to five hospitals of the Department of Medical Service, Bangkok Metropolitan, Bangkok, Thailand; namely, Charoenkrung Pracharak Hospital, Wetchakarunrasm Hospital, Lat Krabang Memorial Hospital, Sirindhorn Hospital, and Klang Hospital. All patients were seen by one of the listed authors. The diagnosis of dengue patients adhered to clinical and laboratory criteria for the diagnosis of dengue patients as established by the WHO (WHO, 1997).

Blood collection for dengue serotype detection was done in all patients according to the following: Viral RNA was extracted from serum/plasma using the QIAamp, according to the manufacturer’s instructions. Viral genomic RNA is converted to cDNA by Reverse Transcriptase (RT). The cDNA is used as template to amplify the DNA fragment [511 base pairs (bp) from the region between capsid and PreM genes by AmpliTaq DNA polymerase with a primer pair D1/D2 in the first round polymerase chain reaction (PCR)]. The type-specific DNA fragments for DENV-1 (482bp), DENV-2 (119bp), DENV-3 (290bp) and DENV-4 (392bp) were then amplified by AmpliTaq DNA polymerase using the 511 bp DNA fragment (the product of the first round PCR) as a template and mixed primer pairs (one forward primer D1 and four reverse primers: TS1, TS2, TS3, and TS4) in the nested PCR (the second round PCR). The DNA fragments amplified by the nested PCR are loaded onto a 1.5% agarose gel and electrophoresised, followed by staining of the gel with ethidium bromide. The specific DNA bands for each DENV serotype are visualized under ultraviolet light (Fig 1) (Lanciotti *et al*, 1992).

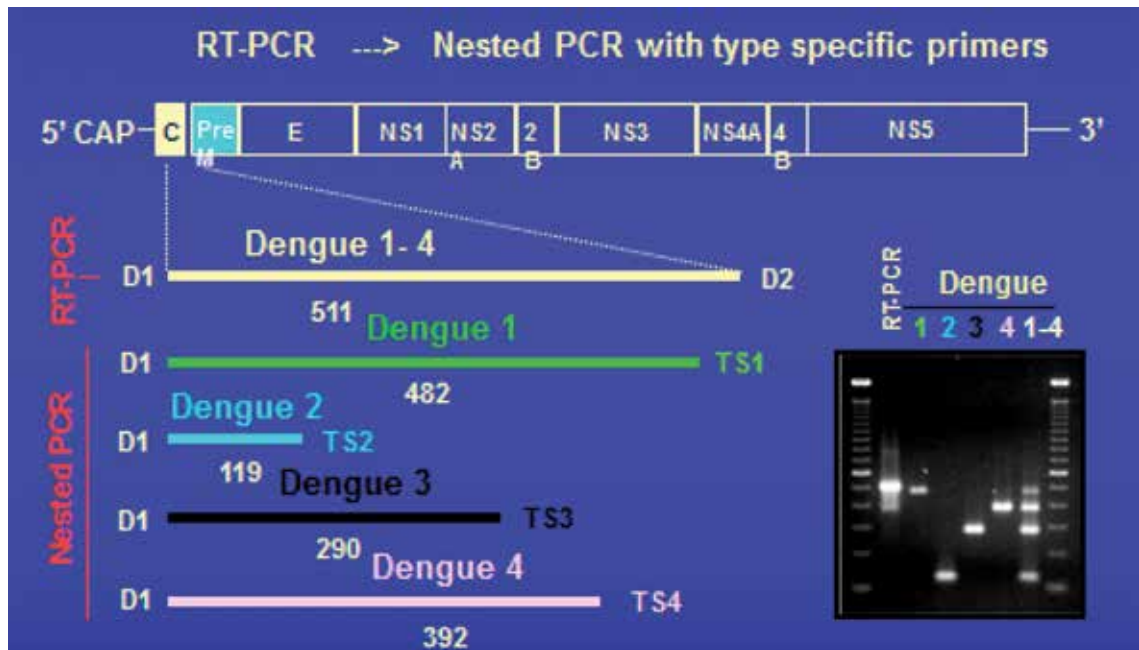


Fig 1– Dengue serotype detection (Lanciotti *et al*, 1992).

Only dengue patients with positive dengue serotype-specific were included for analysis.

RESULTS

From all 660 dengue suspected patients, 472 were positive for dengue serotype-specific which included 254 males and 218 females. Five cases of which were in the 0-1 year age group (1.06%), 19 cases in the 2-5 years age group (4.03%), 60 cases in the 6-8 years age group (12.71%), 214 cases in the 9-15 years age group (45.34%), 103 cases in the 16-30 years age group (21.82%), 60 cases in the 31-60 years age group (12.71%), and 6 cases in the >60 years age group (1.27%) (Fig 2). Detection of dengue serotype in all dengue patients showed 8% DEN-1, 17% DEN-2, 29% DEN-3, 45% DEN-4 and 1% combined serotypes (Fig 3). All dengue serotypes were detected in all age groups and in all severity of dengue diseases (Fig 4, Fig 5).

DISCUSSION

There were two deaths, one was a 22 years old man with DHF, another was an 8 years old

girl with DF. Both were infected with DEN-4. Outbreak of dengue virus infection in Bangkok started in 1958. In the early stages, the outbreak usually occurred every other 1-2 years. Later, the outbreak was unpredictable, and patients were found throughout the year, mostly during the rainy season. During the past decades, the rate of dengue patients in Bangkok varied from 27.99 per 100,000 population in 1992 to 292.24 per 100,000 population in 2001. The case fatality rate was between 0.0-0.21%. A trend towards higher ages of dengue patients was seen (Liulak, 2013).

Our study has indicated that all four dengue serotypes circulate continuously in Bangkok during the period of study with one predominant dengue serotype. Our study confirms the uniqueness of predominant dengue serotype in emerging as the cause of each periodic epidemic as has been seen in the past (Burke *et al*, 1981; Burke *et al*, 1988; Nisalak *et al*, 2003; Nisalak *et al*, 2016). In this study, all severity of dengue diseases can be seen in all age groups no matter they acquired any serotype-specific dengue virus. According to the

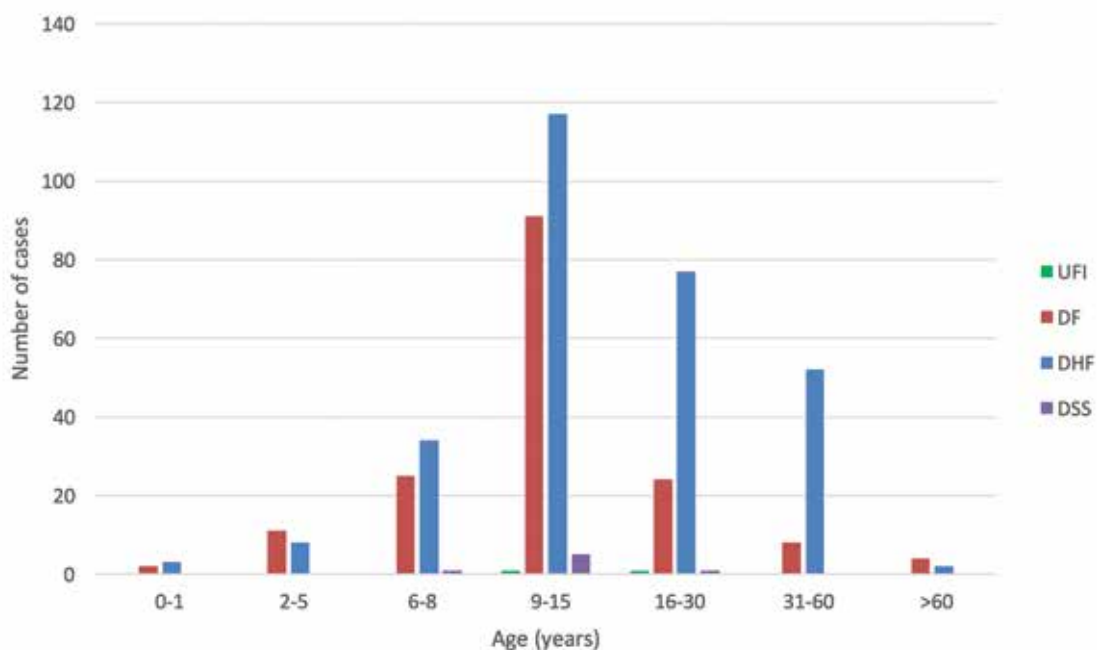


Fig 2– Age distribution vs dengue severity in Bangkok 2015-2016.

DENGUE IN BANGKOK

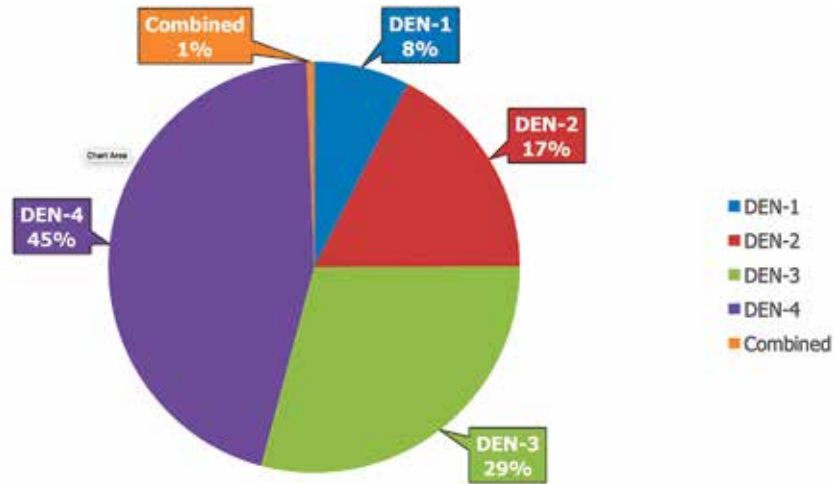


Fig 3– Dengue serotype in Bangkok 2015-2016.

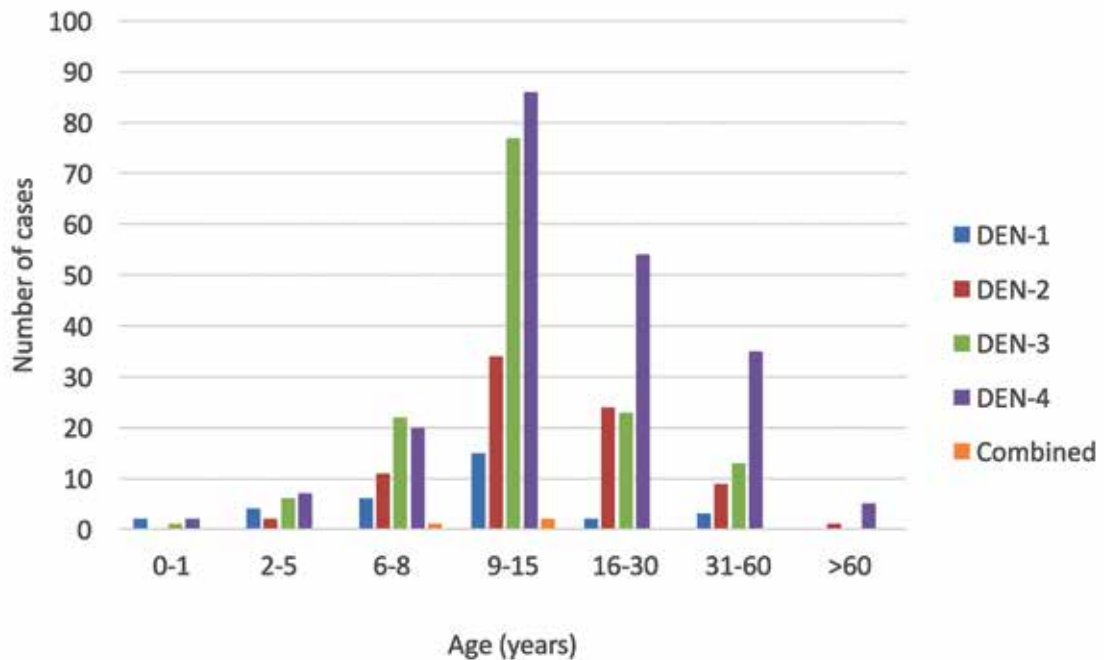


Fig 4– Age distribution vs dengue serotype in Bangkok 2015-2016.

high numbers of cases that were seen in adolescents and adults in this study, co-morbidities in adult may also contribute to the severity of dengue.

Clinical profiles show a difference in some aspects across all age groups and need to

be considered since recognition of clinical characteristics in different age groups are essential in early diagnosis and treatment. Successful treatment, which is mainly symptomatic and supportive, depends on early diagnosis of the

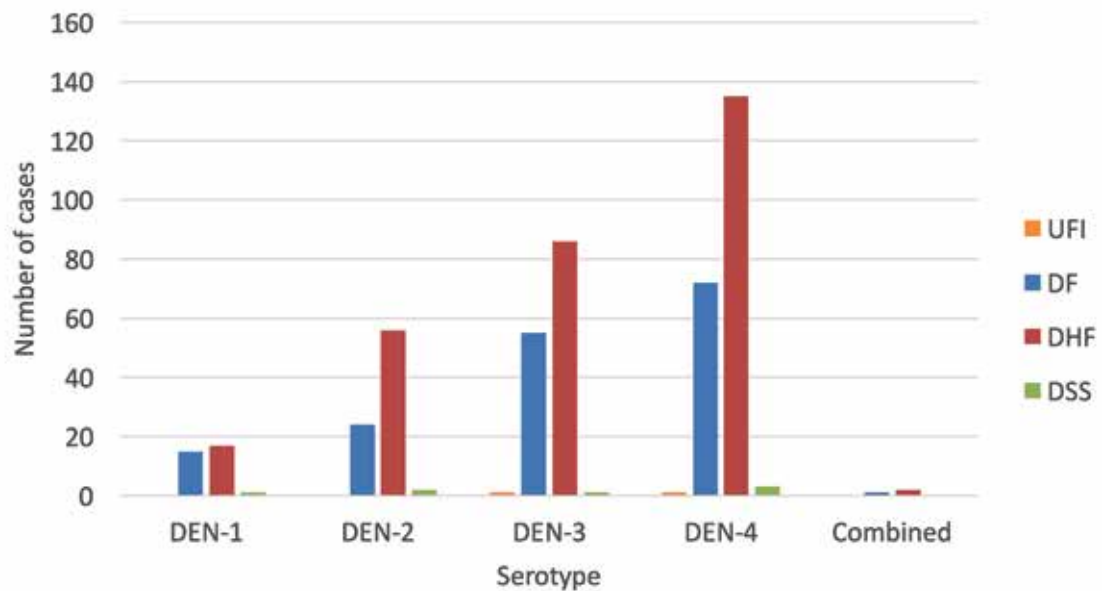


Fig 5– Dengue serotype vs dengue severity in Bangkok 2015-2016.

disease and careful monitoring for the disease severity. (Tantawichien, 2015; Thisyakorn and Thisyakorn, 2017).

Dengue is one disease entity with different clinical manifestations, often with unpredictable clinical evolutions and outcomes. Variations of clinical characteristics in different age group of dengue patients need to be considered for proper management (Royal College Physician Thailand of Thailand, 2015).

We conclude that a long-term surveillance of dengue disease is one of the key strategies for proper prevention and control of dengue epidemic. Our findings show changing dengue epidemiology in Bangkok in terms of age group distribution of dengue patients and dengue serotype-specific distribution in comparison to the past. These results will be an evidence for developing an effective guideline for prevention and control of dengue.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the contributions of the Armed Forces Research

Institute of Medical Sciences (AFRIMS) for laboratory assistance.

REFERENCES

- Burke DS, Nimmannitya S, Nisalak A, Watts DM, Thisyakorn U. Dengue in Bangkok-1980. *AFRIMS Ann Rep* 1981; 81: 83-102.
- Burke DS, Nisalak A, Johnson DE, Scott RM. A prospective study of dengue infections in Bangkok. *Am J Trop Med* 1988; 38: 172-80.
- Lanciotti RS, Calisher CH, Gubler DJ, Chang GJ, Vorndam AV. Rapid detection and typing of dengue viruses from clinical samples by using reverse transcriptase-polymerase chain reaction. *J Clin Microbiol* 1992; 30: 545-51.
- Liulak W. Changing epidemiology of dengue patients in Bangkok Metropolitan, Thailand. *Thai J Pediatr* 2013; 52: 1-6.
- Nisalak A, Endy TP, Nimmannitya S, *et al.* Serotype-specific dengue virus circulation and dengue disease in Bangkok, Thailand from 1973 to 1999. *Am J Trop Med* 2003; 68: 191-202.

- Nisalak A, Clapham HE, Kalayanaroj S, *et al.* Forty years of dengue surveillance at a tertiary pediatric hospital in Bangkok, Thailand. 1973-2012. *Am J Trop Med* 2016; 94: 1342-7.
- Royal College Physician Thailand of Thailand. Practical guideline for management of dengue in adult. *Southeast Asian J Trop Med Public Health* 2015; 46(suppl 1): 169-81.
- Tantawichien T. Dengue fever and dengue hemorrhagic fever in adults. *Southeast Asian J Trop Med Public Health* 2015; 46(suppl 1): 79-98.
- Thisyakorn U, Thisyakorn C. Dengue: global Threat. *Southeast Asian J Trop Med Public Health* 2015; 46(suppl 1): 1-10.
- Thisyakorn U, Thisyakorn C. Childhood dengue diseases: a twenty years prospective study. *Southeast Asian J Trop Med Public Health* 2017; 38(suppl 1): 105-10.
- World Health Organization (WHO). Global Strategy for Dengue Prevention and Control, 2012-2020. WHO Report. Geneva: WHO, 2012.
- World Health Organization (WHO). Dengue haemorrhagic fever; diagnosis, treatment, prevention and control. 2nd ed. Geneva: WHO, 1997.