Policy Forum

Frequency, Duration and Intensity of Dengue Fever Epidemic Risk in Townships in Pearl River Delta and Yunnan in China, 2013[*]

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Dengue fever (DF), one of the neglected tropical diseases[1] also known as breakbone fever, is a mosquito-borne disease common in the tropics and subtropics. Dengue fever is transmitted primarily by *A.aegypti*, resulting in infection with any of four distinct but closely related virus serotypes[2]. The majority of infected people experience a self-limiting clinical course. A small proportion of cases develop into life-threatening Dengue Hemorrhagic Fever or Dengue Shock Syndrome[3]. Thus, DF imposes a heavy economic burden and negatively affects disability-adjusted life years (DALYs) worldwide[4-7].

The prevention and control of DF is difficult, as no vaccine or specific antiviral therapy is available[3,8], and no long lasting cross-immunity between the four distinct serotypes exists, although there is lifelong immunity to the same infected serotype. With increased population migration and the existence of silent or unapparent infections[9], people from non-endemic areas are more susceptible to DF, which makes the effective prevention and control of DF more difficult.

Instead of treatment, prevention and environmental control are the most effective ways to decrease the burden resulting from DF. The three classical approaches to preventing and controlling infectious diseases include controlling the source of infection, reducing the transmission route, and protecting the susceptible population. Different susceptible locations may require different targeted measures based on specific epidemic characteristics.

Previous epidemiological studies mainly focused on incidence and traditional descriptive analysis (such as the distribution of age or sex) at the county or prefectural level[10-13], which provided little information for directing targeted prevention and control measures. Wen et al.[14] proposed a new method to describe characteristics of a DF epidemic from 3 dimensions (frequency, duration, and intensity), which provided more comprehensive information for determining targeted measures. This method has been used to analyze the distribution of DF in Malaysia[15] and provided a convenient and efficient way to determine the targeted measures for controlling the transmission of DF[16]. In addition, it helped public health workers to understand the local epidemic situation within the entire epidemic-affected area. In the current study, we applied this method to describe the epidemic risk at the township level in priority areas of China, 2013 for the first time.

In China, DF is prevalent primarily in the southern provinces[17]. According to the National Notifiable Infectious Disease Surveillance System of Chinese Center for Disease Control and Prevention (founded in 2004), DF outbreaks were sporadic prior to 2013, but the outbreaks and number of cases observed in 2013 exceeded the totals for the previous 9 years, even spreading to central China[18]. The increased economic and medical burdens to patients during 2013 provided an opportunity to describe the epidemic risk characteristics of DF in China. Ninety percent of the cases in 2013 were distributed in Guangdong and Yunnan[10]. Specifically, 99% of the cases in Guangdong and Yunnan occurred in Pearl River Delta of China (PRD) and in two autonomous prefectures [Xishuangbanna Autonomous Prefecture (Xishuangbanna) and Dehong Autonomous Prefecture (Dehong)]. These 3 areas were chosen as our study areas to describe the epidemic risk characteristics of DF at the township level.

Study Area   PRD, which is made up of 7 cities and 402 towns (Figure 1), is the low-lying area surrounding the Pearl River estuary. It is one of the most densely urbanized regions in the world and one of the main hubs of China's economic growth.

Xishuangbanna, famous for its tropical rain

forest, is located in the southern part of Yunnan and is adjacent to Laos, Myanmar, Thailand, and Vietnam. Dehong is located in the western part of Yunnan and is adjacent to Myanmar. A total of 82 towns are located in these 2 autonomous prefectures (Figure 1). The countries adjacent to them all have high incidences of DF[19-20].

The case numbers at the township level for each study area are shown in Figures 2-4.

Data Source With approval and access from the Chinese Center for Disease Control and Prevention, case information was provided by the National Notifiable Infectious Disease Surveillance System based on the onset of DF from Jan 1st to Dec 31st in 2013, including laboratory confirmed cases and clinically diagnosed cases (a total of 2901 and 1408 cases for Guangdong and Yunnan Province respectively). All cases with permanent residential addresses (locations where cases had been living for more than 6 months) located in the study areas were included and used in subsequent statistical analysis.

The population data came from the National Bureau of Statistics of the People's Republic of China. As it concerned a notifiable infectious disease, this study was exempted from the institutional review board assessment.

Statistical Analysis The analysis was performed on towns in each study area individually, instead of regarding the 3 study areas as a whole.

(1) Spatial and Temporal Units to Perform Analysis: Town is the spatial statistical unit, as it is the smallest administrative unit in China. In 2013, 206 of 402 towns in PRD reported cases of DF, and 31 of 82 towns in Xishuangbanna and Dehong reported cases of DF.

As the incubation period for Dengue is 2-15 d, with an average of 6 d, we adopted the time period of a week as the temporal statistical unit, with 51 full weeks in 2013. In this study, a full week means 7 d from Monday to Sunday in the year 2013.

(2) Index Construction and Evaluation: Three indices were calculated for each town, including frequency (probability of occurrence, α), duration (duration of epidemic, β), and intensity (intensity of transmission, γ). A comprehensive index comprised of the 3 indices was then constructed for each town. The definitions and calculation methods of these indices are as follows:
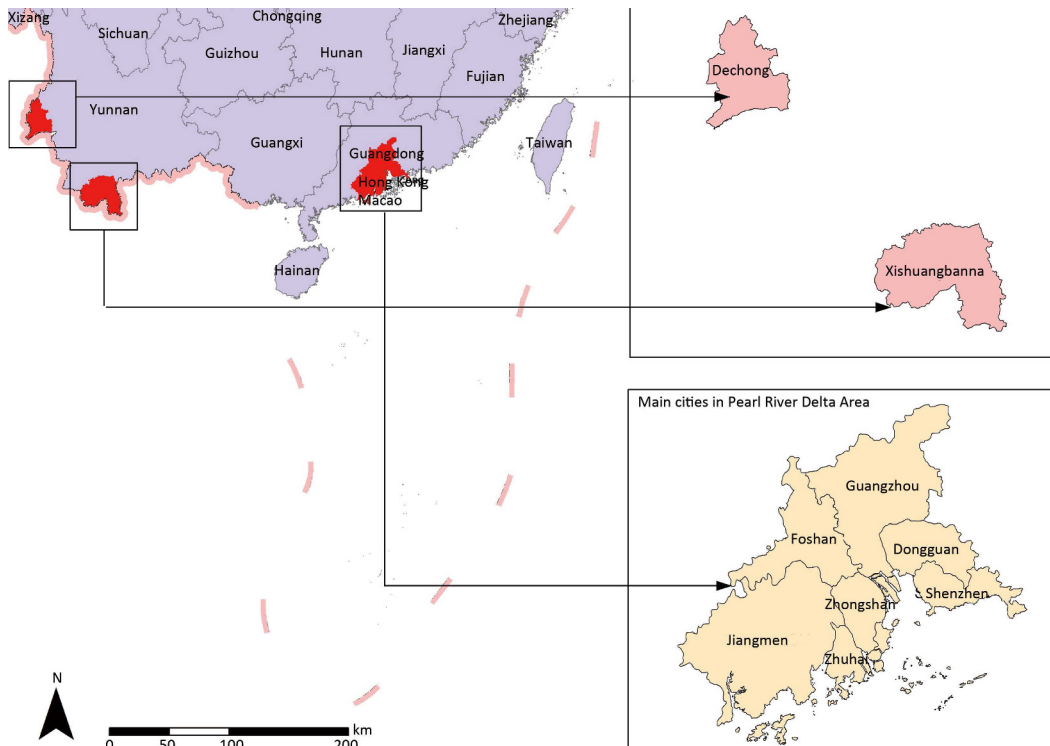
Figure 1. Study areas for Dengue Fever. Purpled area: southern part of China; Pinked parts: two area in Yunnan Province of China; Yellowed Area: main cities in Pearl River delta area, in Guangdong Province of China.