Perspective

# Are imported cases the reason for the increase in the incidence of clinically diagnosed dengue in Anuradhapura district during the year 2017?

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**Abstract**

Dengue has now become endemic in almost all districts of Sri Lanka. An increase in the percentage contribution from North Central Province (NCP) to dengue incidence in the country has been noted since the 2015 dengue outbreak**.** During the year 2017, 338 patients per 100,000 population were reported to have clinically suspected dengue according to the epidemiology unit records. The daily records available at the dengue control unit of regional director of health services office, Anuradhapura, and the freely available data at the epidemiology unit, which comprised of weekly cases of dengue, were extracted and analysed against the meteorological parameters and the vector density data. According to our observations, a statistically significant association between daily rainfall and daily temperature and clinically diagnosed dengue cases does not exist in Anuradhapura. The monthly vector indices did not show any correlation with the monthly incidence of dengue in the medical officer of health area with the highest overall incidence of dengue. The proportion of paediatric patients were also very low in the Anuradhapura district (9%) compared to other districts. Based on these observations, the authors suggest that imported cases of dengue to this district is a major cause of increased incidence of dengue, rather than indigenous transmission in the area.

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Dengue is endemic in almost all districts of Sri Lanka and is causing a significant morbidity and mortality, imparting a heavy burden on health care costs. Despite several vector control measures, dengue cases continue to be reported from all nine provinces of Sri Lanka. An increase in the percentage contribution from North Central Province (NCP) to the dengue incidence in the country has been noted since the 2015 dengue outbreak. Anuradhapura district, which is the main administrative district of the NCP, is situated in the dry zone of Sri Lanka. Dengue has become one of the leading public health issues in this district during the past few years. During the year 2017, 338.1 patients per 100,000 population were reported to have clinically suspected dengue according to the epidemiology unit records [1]. A comprehensive understanding of the temporal and spatial patterns of dengue in this area can help develop mitigation

strategies to prevent the disease and save lives and minimize economic costs [2].

As a part of a postgraduate study conducted during the 2016-2017 period, the daily records available at the dengue control unit, regional director of health services (RDHS) office, Anuradhapura, and the freely available data at the epidemiology unit which comprised of weekly cases of dengue during 2017 were extracted and analysed against the meteorological parameters and the vector density data of the same year. During the process of analysing data in January 2019, our observations on the relationships between weather parameters and the number of dengue cases during 2017 lead us to think of the concept of imported cases, rather than autochthonous cases, as a cause of the increase in dengue as well as the fluctuations that occur in the incidence.

Dengue is believed to be an infection with a seasonal pattern [3, 4]. In Sri Lanka, dengue has shown a seasonal trend, where two peaks of dengue occur: one following monsoon rains in the southwestern monsoon (June–July) and the other following northeastern monsoon (September–December) [5,6].

In Anuradhapura district, A total of 2124 clinically diagnosed dengue patients were reported during 2017. The maximum number of patients documented during a month was 480, and it was seen in July. The minimum count of 48 patients was reported in September (IQR= 136.75). The maximum daily rainfall of 136 mm was observed in mid-May. The reported minimum daily temperature of $25.1^0C$, was observed in January, and the maximum temperature of $38.1^0C$ was recorded in June. A statistically significant association between daily rainfall and daily temperature and dengue cases was not revealed (Table 1). Furthermore, the monthly rainfall did not show an association with the number of dengue cases reported from Anuradhapura each month (Figure1).

**Table 1: Correlation between the daily number of reported dengue cases and the daily meteorological parameters in Anuradhapura district during the study period.**

| | Pearson correlation coefficient | P-value | Remarks |
|---|---|---|---|
| Mean temperature | -0.008 | 0.884 | No statistically significant correlation |
| Rainfall | -0.008 | 0.877 | No statistically significant correlation |
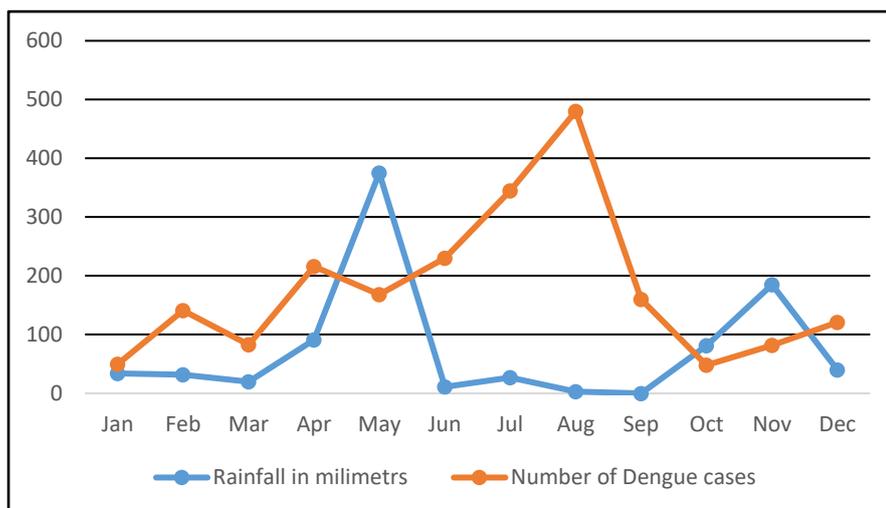


**Figure 1: Monthly rainfall and the number of dengue cases in Anuradhapura district (2017)**

The monthly vector indices did not correlate with the monthly incidence of dengue in the medical officer of health (MOH) area with the highest overall incidence of dengue (Table 2). Though we did not find a relationship between dengue vector abundance and the meteorological parameters, studies reported from other parts of the country have shown the existence of such a positive relationship [6].

**Table 2: Statistical significance of vector indices with the incidence of dengue in Nuwaragam Palatha East, Anuradhapura district**

|  |  | Correlation coefficient | P-value |
|---|---|---|---|
| **House index** | *Aedes aegypti* | 0.432 | 0.161 |
|  | *Aedes albopictus* | 0.196 | 0.540 |
| **Container index** | *Aedes aegypti* | 0.071 | 0.820 |
|  | *Aedes albopictus* | 0.357 | 0.254 |
| **Breteau index** | *Aedes aegypti* | 0.139 | 0.236 |
|  | *Aedes albopictus* | 0.666 | 0.460 |

The proportion of paediatric patients were also very low in the Anuradhapura district (9%) compared to the Western province (57%) as reported by Sirisena et al. (2014) and the Northern province (26.5%) as reported by Muruganathan et al. (2014) [7,8]. This low percentage in the Anuradhapura district is unusual compared to other regions of the country. As this district had been among the areas with a low incidence of dengue, the seroprevalence of dengue is low, and as such secondary dengue infection is expected to be rare compared to western and other provinces where the prevalence is high. Hence, secondary dengue infection is likely to be low in the population aged less than 13 years. The concept of imported cases explains this observation also. It is known that a considerable number of adults move temporarily to the Western province in search of jobs [9]. Furthermore, it is not uncommon to see that a reasonably high percentage of dengue patients working in areas outside NCP, mainly in Colombo, where they may acquire the disease. In such a situation, the working-age group is more likely to be affected than children, as depicted in this study.

In a study conducted in Cairns, Australia, using both imported and autochthonous cases of dengue, it has been shown that the seasonal pattern is not obvious with imported dengue cases [10]. However, the same authors suggest that imported dengue fever cases significantly influence the numbers of local dengue fever cases under favourable weather conditions.

The current study shows that no direct relationship exists between the vector indices, meteorological parameters, and the incidence of dengue may support the concept of imported dengue cases to this district rather than indigenous transmission. Sri Lanka, being a small country, the weather status in one part of the country may not differ greatly to another area compared to other countries with large geographical variations. The seasonal pattern of dengue which is clearly evident in Colombo, Gampaha, and Kandy districts with a higher incidence of dengue, may influence the incidence of dengue in other nearby districts.

However, though the cases are imported to Anuradhapura at the initiation of dengue outbreaks, it does not mean that the Anuradhapura district and NCP are free of indigenous transmission. The imported cases may spread the infection through the vectors, and eventually, autochthonous transmission could come into action. This has been discussed by Huang et al. (2013), explaining their results in which monthly autochthonous dengue cases showed a strong positive association with monthly imported dengue fever cases [10]. Even though mosquito

indices values are low, there are vectors in Anuradhapura, and as such, spreading of infection is possible from the affected patients to the vectors and then to people residing in this area. Therefore, vector control should be conducted in this area vigilantly, and the temporal and spatial distribution of the vector indices should be considered in planning and implementation of such preventive measures. At the same time, regular vector sampling over longer durations would be important in understanding vector behaviours in the region.

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