

## Original Article

# POST-MONSOON SEASON SURVEILLANCE A MUST FOR CURTAILING ANNUAL DENGUE EPIDEMIC IN RURAL INDIA

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## INTRODUCTION

Dengue fever is endemic to Indian subcontinent. It usually takes epidemic form annually. This incidence of epidemic proportions is usually related to the seasons of weather in the subcontinent especially monsoons. There have been studies about the correlations and predictions of the incidence, timing including lag time, and severity of annual dengue epidemic with the weather conditions mainly rainfall, temperature and relative humidity. However, either these studies were done outside India or metropolitan cities in India (1-2).

The current study was planned to document whether there is a correlation of these weather conditions (over a period of five years period 2008-2012) with annual dengue epidemic's variability in the capital city of hill

## ABSTRACT

**Background:** Dengue fever takes epidemic form annually. This incidence of epidemic proportions is usually related to the seasons of weather in the subcontinent especially monsoons.

**Objectives:** The current study was planned to document whether there is a correlation of these weather conditions (over a period of five years period 2008-2012) with annual dengue epidemic's variability in the capital city of hill state of northern India that is largely rural areas covering tough mountainous terrains.

**Methods:** The monthly meteorological data about monthly mean temperatures, monthly cumulative rainfall, and monthly mean relative humidity were collected from local office of India Meteorological Department for the years 2008-2012 in the capital city of hill state of northern India. Subsequently, the mandatory reports of the monthly incidence of new dengue cases for the same period were collected from District Headquarters for final correlation of dengue cases incidence with climate conditions.

**Results:** The dengue epidemic peaked in Octobers after two-month lag period from the peaked rainfalls and relative humidity in Augusts. This rightward shift of dengue epidemic in relation to the weather graph of the city continued till the end of Novembers, even though monsoon seasons ended in Septembers.

**Conclusion:** There is two-month lag period for incidence and peaking of dengue fever epidemic in comparison to the monsoon season suggesting the need of continuous dengue surveillance well beyond after the end of monsoon season.

**Keywords:** Dengue, epidemic, monsoon, rural

state of northern India that is largely rural areas covering tough mountainous terrains.

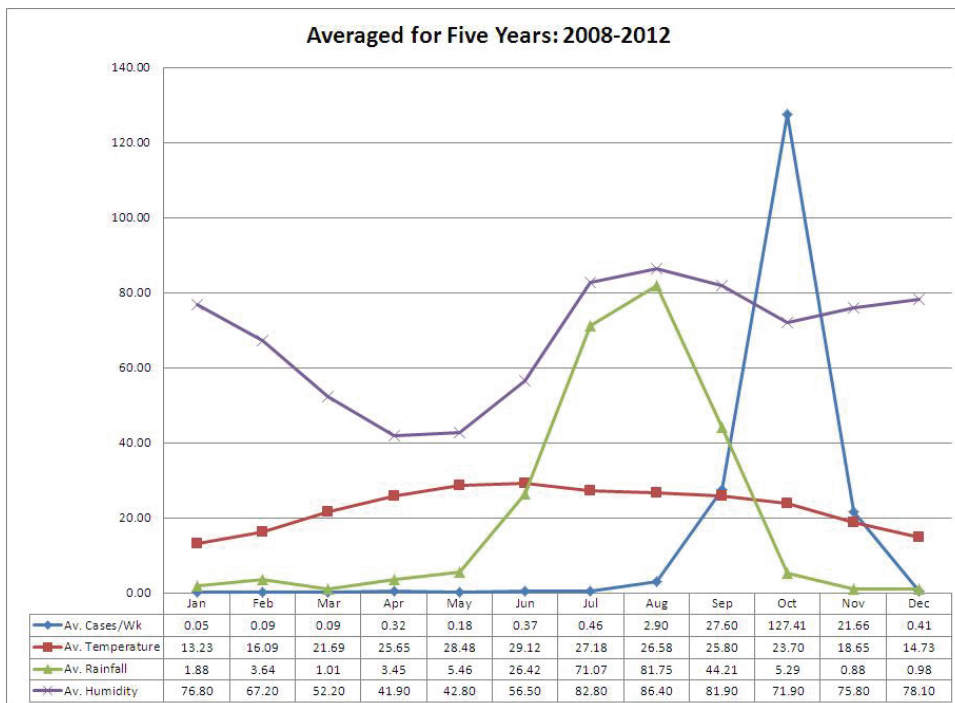
## MATERIALS AND METHODS

After institutional review board approval, the monthly meteorological data about monthly mean temperatures, monthly cumulative rainfall, and monthly mean relative humidity were collected from local office of India Meteorological Department for the years 2008-2012 in the capital city of hill state of northern India. Subsequently, the mandatory reports of the monthly incidence of new dengue cases for the same period were collected from District Headquarters. Finally, these data were averaged for all five Januarys, all five Februarys and so on to see the monthly trends of incidence of annual dengue epidemic in relation to the

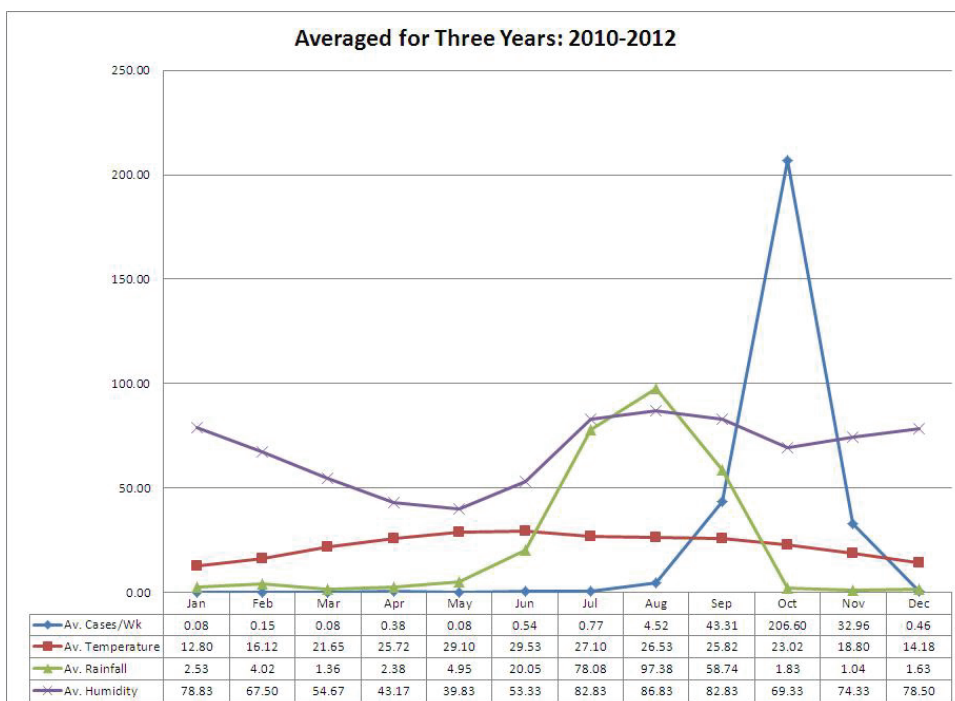
monthly trends of weather conditions (temperatures, rainfall, and humidity).

The data collected for each year from 2008-2012 and subsequently, the monthly data for dengue fever cases per week, temperatures, rainfall and relative humidity were averaged over the five years and is graphically shown in Figure 1.

**RESULTS**



**Figure 1:** Data Averaged for five year period: 2008-2012



**Figure 2:** Data Averaged for three year period: 2010-2012

The dengue fever cases per week in a month were defined by average cases per month divided by 4.34812

weeks in a month. The monsoon seasons started in June; but the dengue cases started showing up in Au-

gusts with two-month lag period. Moreover, the dengue epidemic peaked in Octobers after two-month lag period from the peaked rainfalls and relative humidity in Augusts. This rightward shift of dengue epidemic in relation to the weather graph of the city continued till the end of Novembers, even though monsoon seasons ended in Septembers.

As the reported numbers of dengue cases were very low in 2008-2009 (most likely secondary to community's laxity in case reporting and surveillance), the further analysis of only three years (2010-2012) also reinstated similar two-month lag period between weather conditions and peaked incidence of dengue cases as shown in Figure 2.

After correcting the lag period of two months, the monthly weather data correlated adequately with monthly dengue cases per week for 2010-2012. These correlation coefficients for dengue cases per week with temperatures, rainfall and relative humidity were 0.31, 0.84 and 0.48 respectively reflecting the dengue cases correlated positively with increased rainfall, increased relative humidity and increased temperatures in that descending order after correcting the lag period of two months.

## DISCUSSION

The current focuses of the ongoing studies around the world are focussing on the prediction models to predict the amount of cases based on the veracities of weather conditions. The intentions of these prediction models are to ensure that the preparations and allocations of dengue prevention and dengue fever management funds for these annual epidemics can be judiciously and timely performed to curtail this major burden on the health care costs of the societies (3-6). However, the public health concerns in small rural and non-metropolitan areas are somewhat different.

Firstly, the major interpretation of this data for local governments and community at large in the hill state of northern India is that the aggressive surveillance should continue even after monsoons. Personal as well as societal guards against flourishing *Aedes aegypti* mosquitoes (the vector forms for dengue viruses) should not be dropped down as soon as the monsoons are over. Secondly, as compared to almost completely health-insurance-covered developed countries, the prediction models of exact number of cases may not matter to the public health concerns in rural areas wherein most of the costs are covered by the patients through self-payments. The only concerns for the local infrastructure will be proper awareness programs of basic level health-care institutions to provide adequate dengue related care, adequate stock-piling in-advance for the blood and blood related products like platelets, and allocation and preparation of appropriate hospital floors for the dengue management in the projected and predicted times of annual dengue epidemics. The predicted times apparently following two-month lag

period (more appropriately called lead-time in the overlapping scenario of dengue cases incidence and veracity of weather conditions) can ensure more aggressive surveillance for dengue fever by the local community. The reason for lag period can be somewhat explained by short (0-6weeks) or long (0-30weeks) lag periods seen in densities of *Aedes aegypti* mosquitoes in relation to environmental temperature and rainfall (7).

## CONCLUSION

In summary, there is two-month lag period (more appropriately called lead time) for incidence and peaking of dengue fever epidemic in comparison to the monsoon season suggesting the need of continuous dengue surveillance well beyond after the end of monsoon season (June to September).

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