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## **A historical comparative research on vector borne disease: An Indian scenario**

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### **Abstract**

All the developing countries with tropical climate are facing challenges among the population with vector borne illness as seasonal problem. In this article we discussed the vector borne diseases reported in India on different time point, mainly the reported cases of dengue, malaria and Japanese encephalitis from different region of the country were collected from the national vector borne diseases control website in the years 2011, 2013 and 2016. Compared to Japanese Encephalitis and Dengue there was significant increase observed in Malarial incidence cases during this time period.

**Keywords:** Dengue, climate change, regional zone, malaria, Japanese encephalitis

### **1. Introduction**

Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. Many of these vectors are bloodsucking insects that ingest disease-producing micro-organisms during a blood meal from an infected host (human or animal) and later inject them into a new host during their next blood meal. Mosquitoes are the best-known disease vector [1]. Mosquitoes are surviving on earth since millions of years. People fight globally against mosquitoes and mosquito borne diseases. Mosquitoes are very well recognized as vectors of protozoan, viruses and other pathogenic organisms, after the discoveries made by Sir Patrick Manson, Sir Ronald Ross and Sir Walter Reed [2]. Malaria, dengue, filariasis, Japanese encephalitis, west Nile virus and chikungunya are the major diseases spread globally by different mosquito. These diseases challenge the developed and developing countries of the world for eradication [3]. Every year more than one billion people are infected and more than one million people die from vector-borne diseases including malaria, dengue, schistosomiasis, leishmaniasis, Chagas disease, yellow fever, lymphatic filariasis and onchocerciasis. One sixth of the illness and disability suffered worldwide remains due to vector-borne diseases, with more than half the world's population currently estimated to be at risk of these diseases [4]. Dengue fever is infectious disease caused by a group of virus belongs to the genus flavivirus transmitted by female Aedes mosquitoes and the infection is rapidly emerging vector-borne viral disease with a 30-fold increase in global incidence over the last five decades. It is a major public health concern throughout tropical and subtropical regions of the world [5]. India contributed 6-9% of total cases in South-East Asian Region (SEAR) countries between 2009 and 2011, which has increased to 19% in 2013 [6]. Around 95% of the Indian population lives in areas at risk of malaria. Annually, more than 100 million blood slides are examined for malaria, with around one million cases of malaria reported in the country. Populations affected are mostly low-income groups, earning less than Rs 6000 per month. Of these, around 50% are falciparum malaria cases. Annual malaria incidence in India is 0.69 cases/1000 population [7]. However, outbreaks are being increasingly documented in rural areas also. An epidemic was reported in 2012, with over 50000 cases and about 250 deaths. Moreover, a major epidemic of chikungunya was reported in 2008 with about 1.3 million cases in 213 districts in 15 states. Though it is showing a decreasing trend, cases continue to occur, particularly in southern states of India [8]. Japanese encephalitis (JE) across the country accounts for less than 15% of all Acute Encephalitis Syndrome (AES) as the incidence has declined with introduction of an effective vaccine.

The patterns of AES are different in different states caused by a range of etiologic agents, which has prompted the Government to employ a multi-sect oral collaborative approach to control AES. Japanese encephalitis is reported to occur in southern, north and northeastern states, with about 1000 cases annually and deaths ranging from 100-200 in number [8]. According to WHO bulletin many countries in Asia experienced unusually high level of Dengue or dengue haemarrage fever in 1998 the activity being higher than many other years due to changes in weather pattern.

**2. Materials and Methods**

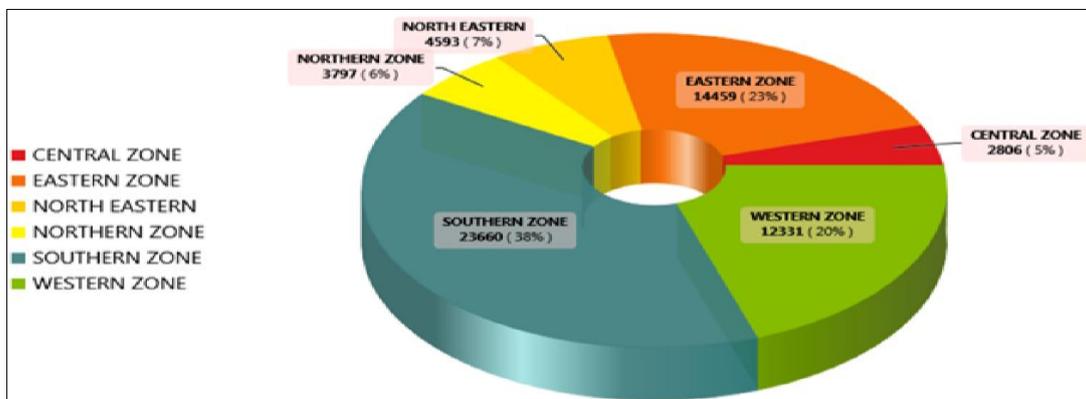
The data about vector borne diseases like Dengue, Malaria, and Japanese encephalitis the number of cases reported were collect for three time point with the purpose of comparing the data for 2011, 2013 and 2016 from the NVBDCP website for all the three years and the data were enter in the excel sheet for analysis in addition to this meterological report were referred and compared as per the zone classification which was developed for vector borne diseases. The states were grouped as North India, North East India, Central India, East India, West India and South India. North India includes of the states Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu

and Kashmir, Punjab and Rajasthan. The States Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Tripura and Nagaland Grouped in to North East, the states such as Chhattisgarh, Madhya Pradesh, Uttar Pradesh, and Uthrakand consist of Central India, the state's Sikkim, Bihar, Odisha, Jharkhand and West Bengal grouped into East India and Goa, Gujarat, Damon and Diu treated as West India and Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Andaman and Nicobar, Lakshadweep, Telangana and Pondicherry grouped into South India. Epi-info version 7.0 was used for graphical presentation.

**3. Result**

**3.1 Dengue cases in India**

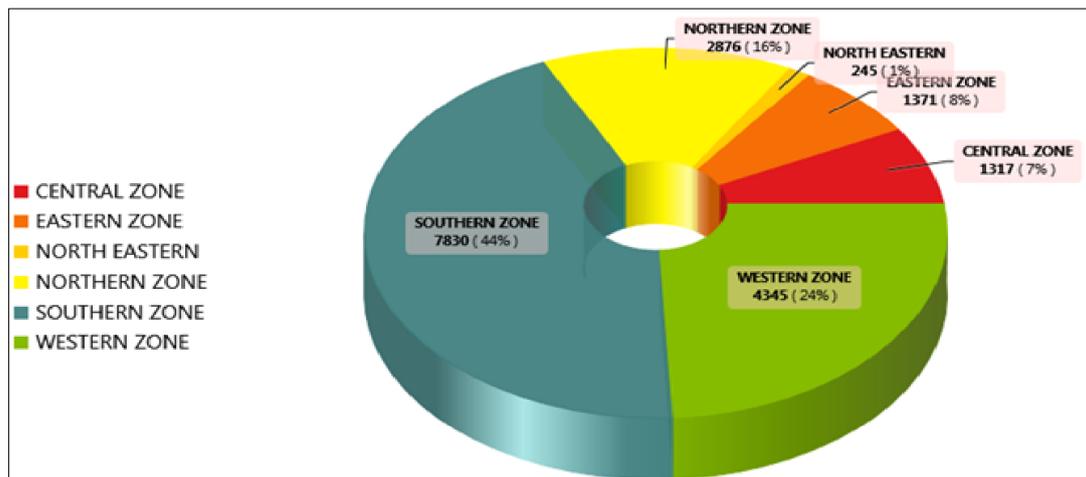
As per fig 1. a total of 56,840 dengue cases were reported in the year 2010. We observe that in the year 2010, the Southern Zone of India had a prevalence of 38 % (23660 cases) followed by Eastern Zone with 23 % (14459 cases). Western Zone was the third highest with 20 % prevalence (12331 cases). The North Eastern Zone had 7 % (4593 cases) and Northern Zone 6 % (3797 cases) Central Zone of India had the least percentage of dengue cases, 5 % (2806 cases).



**Fig 1:** Dengue cases in India 2010

In the year 2013 (fig 2) still, the total number of dengue cases had decreased to 17,894 cases from 56, 840 in 2010, the southern Zone had the highest percentage of dengue cases, 44 % (7830 cases). The Western Zone has the second highest percentage of Dengue cases with 24 % (4345 cases) followed

by Northern Zone with 16 % (2876 cases). It is to be noted that there has been a drastic decrease in the number of dengue cases in Eastern Zone from 14459 cases (23 %) in 2010 to 1371(8 %) cases in 2013. The North Eastern Zone had the least percentage of cases, 1 % (245 cases) in the year 2013.



**Fig 2:** Dengue Cases in India 2013

As per fig 3 there was an overall unexpected increase of 80,953 dengue cases in the year 2016 when compared with 17,894 cases in the year 2013. The Eastern Zone displayed rapid rise in the number of dengue cases from 1371 cases (8%) in 2013 to 28402 cases (30 %) in 2016. The Southern

Zone had the second highest number of cases with 22515 cases (24 %). The western Zone reported 18959 cases (20%) in the same year. Northern Zone reported the least number of cases, 4505 (5 %).

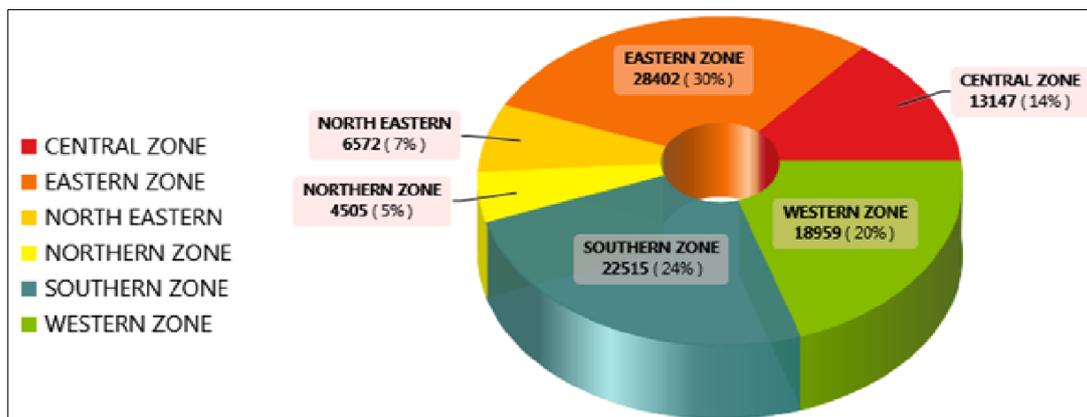


Fig 3: Dengue Cases in India 2016

The fig 1, 2 and 3 clearly shows that the southern zone account for majority of dengue cases reported in India in 2010 which is 38% while in 2013 the cases reported from southern zone further increased to 44% and later in 2016 there was a decrease in the percentage of cases to 24. The second highest percentage of cases was reported from eastern zone at 23% in 2010 and it decreased to 8% by 2013 and there was a drastic increase in the cases by 2016 to 30%. Western zone reported 20% cases in 2010 and in 2013 it increased by 4% and in 2013 it again became 20% in 2010. Central zone reported 5% of cases in 2010 and in 2013 it increased by 2% and became 7% and in 2016 it became double i.e. 14%. Northern zone reported 6% of cases in 2010 and in 2013 it drastically

increased to 16% and in 2016 it decreased to 5%. The percentage of cases reported in North-Eastern zone was 7% and in 2013 it decreased to 1% and in 2016 it was reported to remain 5%.

### 3.2 Malaria Cases in India

As per fig 4 a total of 13, 11,000 malaria cases were reported in the year 2011 in India. The Eastern Zone reported the highest number of cases, 5, 39,000. The Central Zone of India reported the second highest number of malaria cases in that year of 2, 87,000 cases. The Southern Zone had reported the least number of malaria cases, 85,000 in the year 2011.

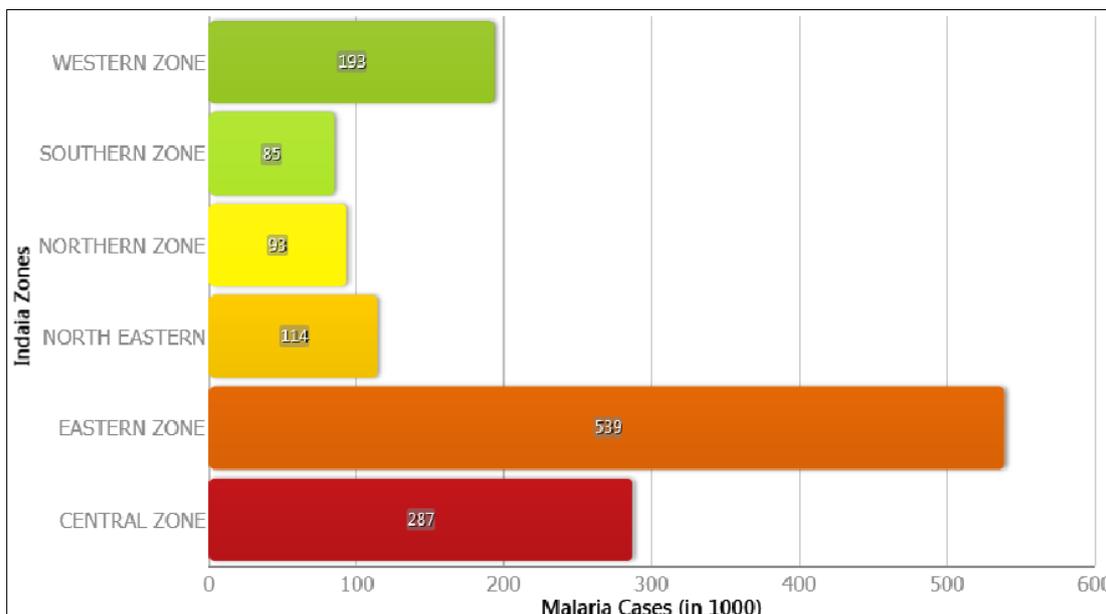
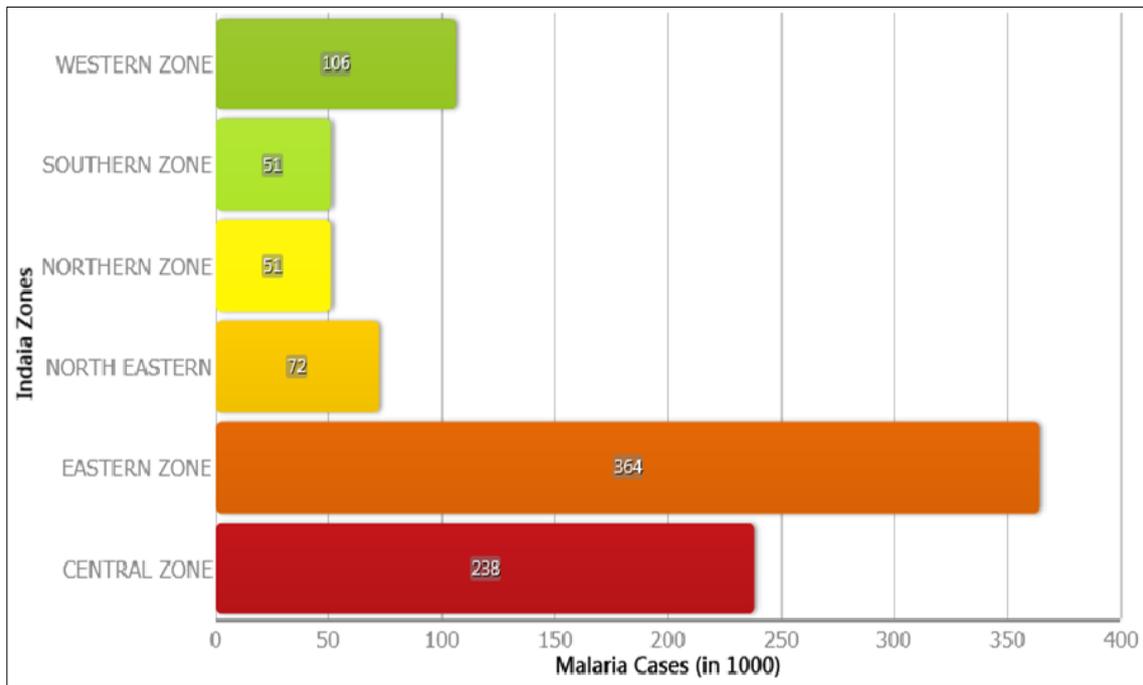


Fig 4: Malaria Cases in India 2011

The overall number of malaria cases decreased to 8, 82,000 in the year 2013 (fig 5). The Eastern Zone remained in the top position for reporting the highest number of malarial cases with 3, 64,000 cases of malaria in the year 2013. The Central

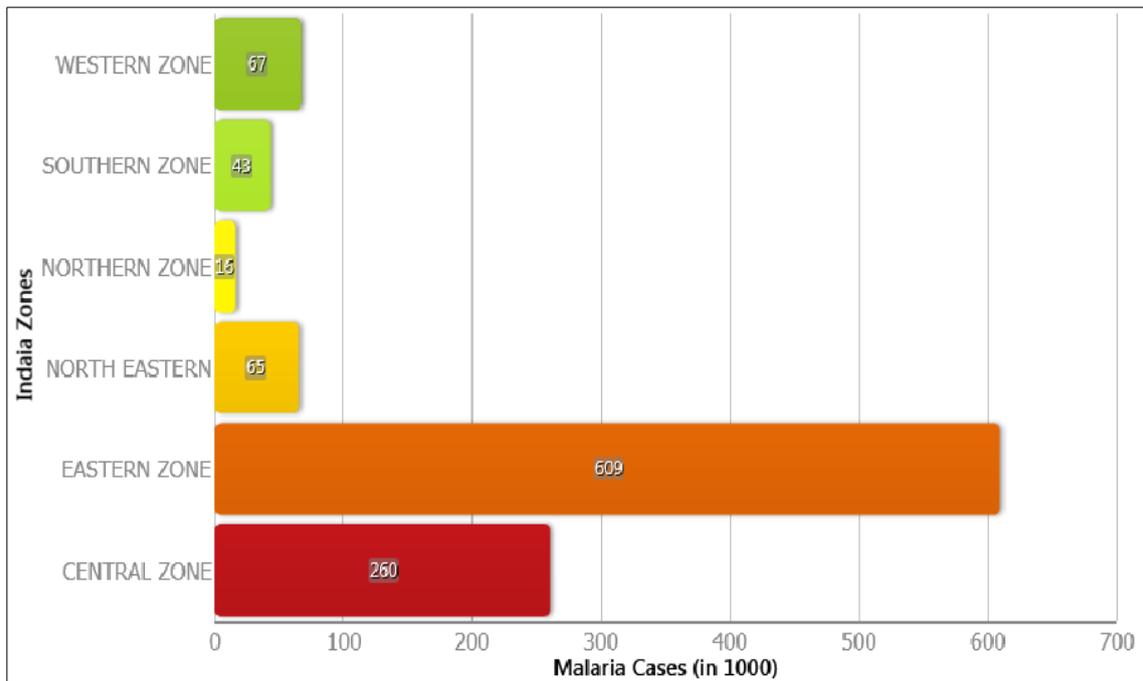
Zone of India consecutively reported the second highest malarial cases with 2, 38,000 cases. The Northern Zone and Southern Zone reported the lowest number of malarial cases with 51,000 cases each in the year 2013.



**Fig 5:** Malaria Cases in India 2013

There was a steep increase of malarial cases in the year 2016 (1059424 cases) from 2013 (881691 cases), (fig 7). The Central Zone had 2,60,000 malarial cases reporting the second highest position in India. The Western Zone reported 67,000

cases followed by North Eastern Zone with 66,000 malarial cases. The Northern Zone reported the least number of cases with 16,000 cases of malaria (fig 6).



**Fig 6:** Malaria Cases in India 2016

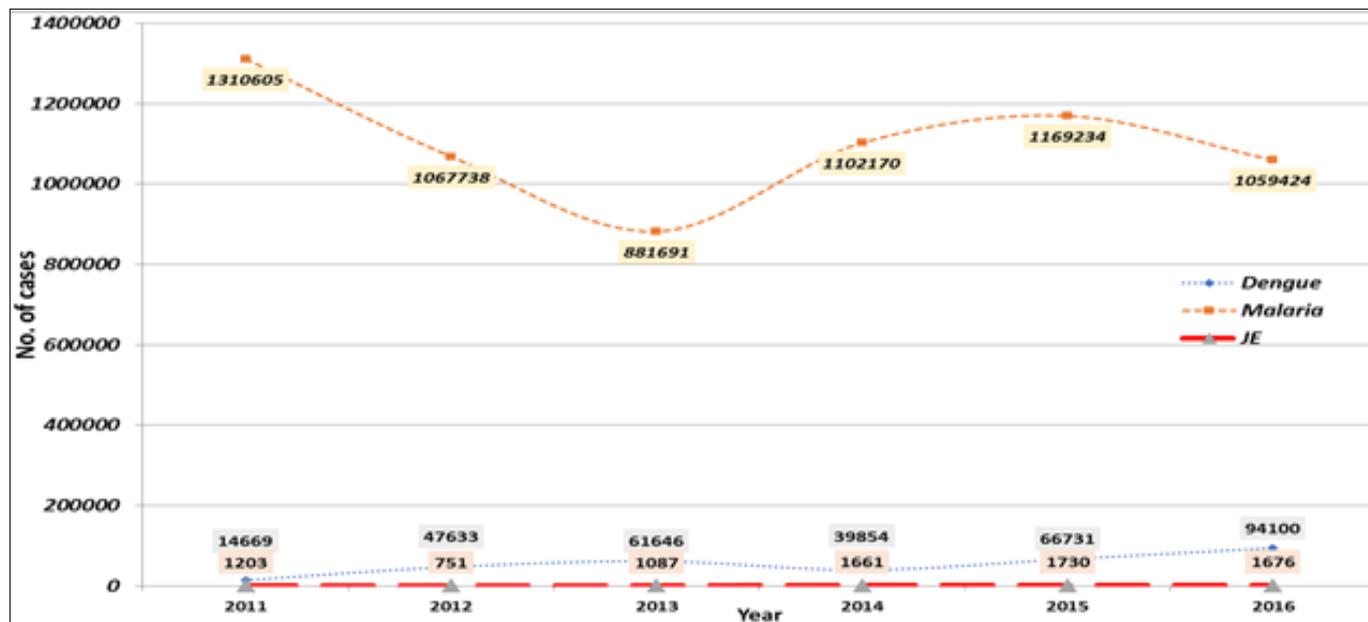


Fig 7: Vector Borne Diseases in India 2011-2016

The graph (fig 4, 5 & 6) indicates that in 2011 the highest number of cases were reported from eastern zone i.e. 539 per 1000 cases and in 2013 it decreased to 364 per 1000 cases and in 2016 it increased to 609. And central zone reported the second highest number of cases i.e. 287 per 1000 cases in 2011 and 238 in 2013 and 260 in 2016. Western zone reported 193 per 1000 cases in 2011 and it decreased to 106 cases in 2013 and it again drastically decreased to 67 per 1000 cases in 2016. North eastern zone reported 114 per 1000 cases in 2011 and it decreased to 72 in 2013 and further decreased to 64 in 2016. Northern zone reported 93 per 1000 cases in 2011 and it decreased to 51 in 2013 and decreased to 16 per 1000 cases in 2016. Southern zone reported 85 cases in 2011 and 51 cases in 2013 and again decreased to 43 by 2016.

### 3.3 Japanese Encephalitis Cases in India

From the graph (fig 8, 9 & 10) it could be interpreted that in

2010 central zone accounted for highest number of JE cases i.e. 332 per 1000 cases and in 2013 it decreased to 281 and in 2016 it further increased to 410 per 1000 cases. North eastern zone reported the second highest number of cases in 2010 being 189 per 1000 cases and in 2013 it drastically increased to 513 per 1000 cases and again increased to 619 by 2016. However eastern zone reported the least number of cases in 2010 i.e. 3 per 1000 cases but it dramatically increased to 243 in 2013 and doubled in 2016 to 563 which being the second highest number of cases reported in 2016 after north eastern zone. Southern zone accounted for 21, 44 and 68 per 1000 cases in 2010, 2013 and 2016 respectively which seem to be a consistent increasing trend in JE. Northern zone reported 9 cases in 2010 and 3 cases in both 2013 and 2016. Similarly, western zone accounted for 9 cases in 2010 and 3 cases in 2013 and 13 cases in 2016.

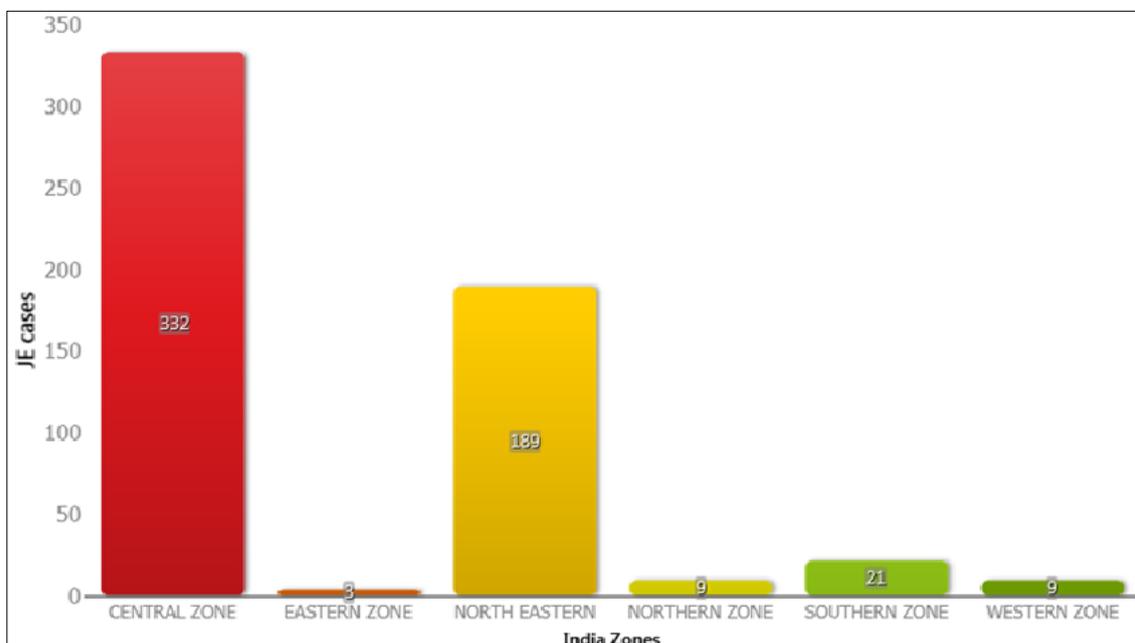


Fig 8: JE cases in India 2011

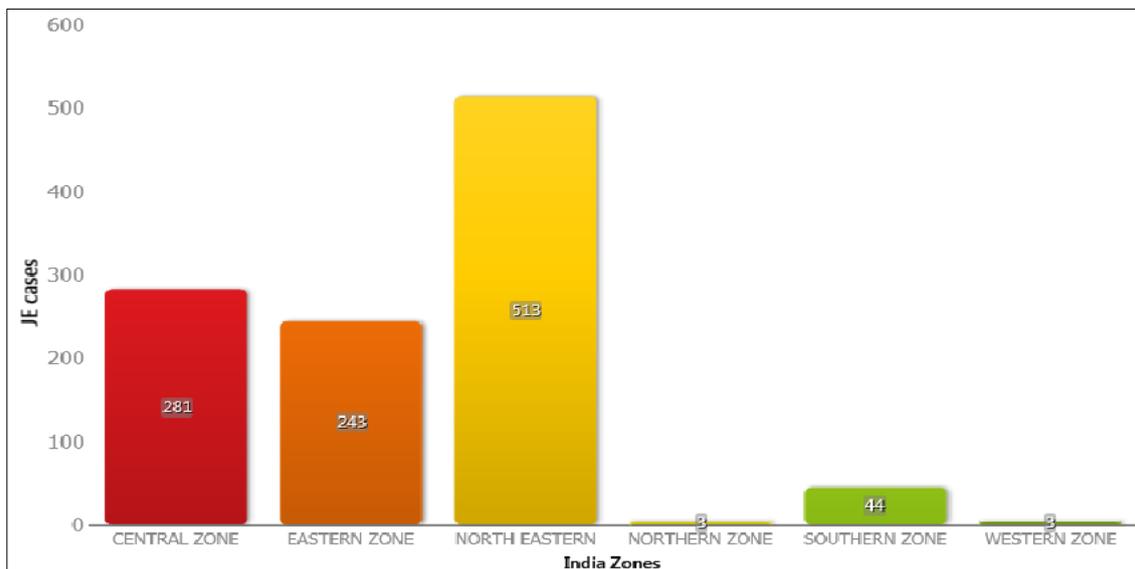


Fig 9: JE cases in India 2013

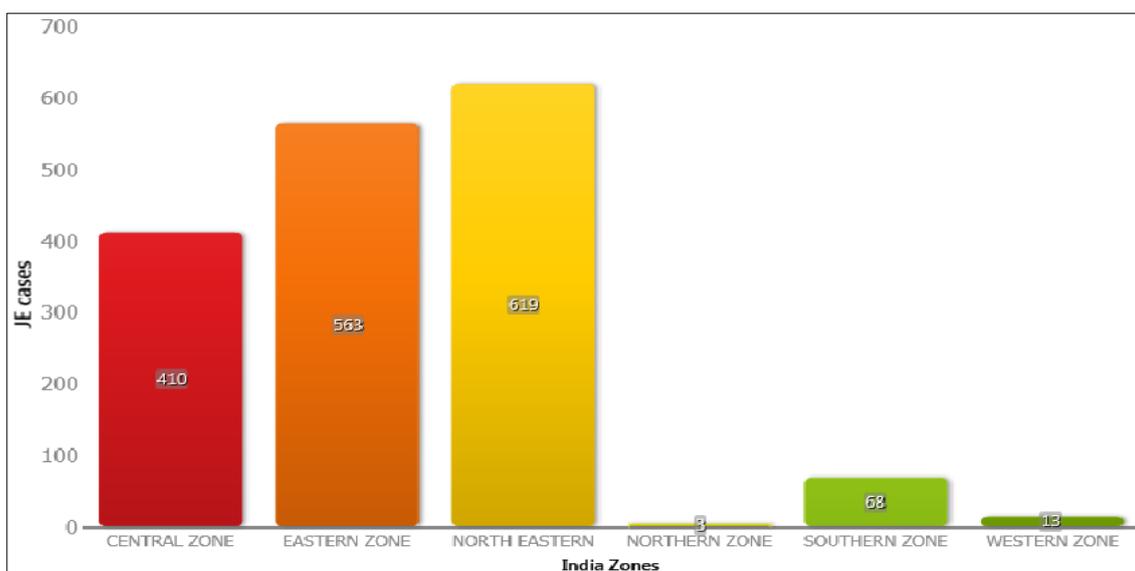


Fig 10: JE cases in India 2016

**4. Discussion**

Current status of Dengue and Chikungunya in India (2014) Dengue a flavivirus transmitted by aedes mosquitoes in India, Dengue is widespread and endemic in most major cities such as Andhra Pradesh, Goa, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, West Bengal and Uttar Pradesh, Chandigarh and Pondicherry [9]. Awareness on mosquito larva breeding, keeping the environment clean without any water stagnation and using lid for household level water storage container for to avoid mosquito breeding and at household level use of mosquito net and natural repellents will help in preventing mosquito bites.

Vector borne illness as seasonal problem rain followed by hot temperature. According to Malaria in India report (2017) the biggest burden of malaria in India is barren by the most backward, poor and remote parts of the country with > 90-95% cases reported from rural areas and <5-10% cases from urban areas. The State of Odisha with a population of 36.7 million (3.5%) contributes about 25% of the total annual malaria cases more than 40% of *p. palciferum* malaria cases

nearly 20-30% of death caused by malaria in India followed by the Meghalaya, Mizoram, Maharashtra, Rajasthan, Gujarat. Karnataka, Goa and southern Madhya Pradesh, Chhattisgarh and Jharkhand and they have pointed out urbanization, drought, migration of the workers, poor control efforts are contributing factors for malaria in India [10].

A review of Japanese Encephalities in Uttar Pradesh India report (2012) indicates that the state of Uttar Pradesh is highly endemic for Japanese Encephalities. The common domestic animal includes cow, buffaloes, goat, dog and horse, the pig is known to be the amplifier host for Japanese Encephalities virus. The rainy season being June to September and average rainfall of 99cm and temperature 30-44 degree Celsius is a catalyzing agent for Japanese Encephalities. In the State Uttar Pradesh, the districts Gorakpur, Kushinagar, Maharajganj, Saint Kabin Nagar and Siddharth Nagar are most affected by flood by major rivers [11].

**5. Conclusion**

Vector borne diseases are a serious public health issue in India. Malaria is one of the six major vector-borne diseases in

India. The six-year data showed large number of Malaria cases were recorded in India (Fig. no 10). Particularly Central and Eastern parts of the Indian states are recorded a greater number of Malaria cases (Fig no 4, 5 & 6). An anopheline vectors are (*Anopheles culicifacies*, *Anopheles fluviatilis*, *Anopheles stephensi*, *Anopheles minimus*, etc..) plays a major role for spread malaria in India. Dengue is another serious vector borne disease in India in last six decades. An *Aedes* mosquitoes (*Ae. aegypti* and *Ae. albopictus* etc..) plays a major role for spread Dengue in India. In results (fig no 1, 2 & 3) showed southern states continuously recorded high dengue incidence in every year because of positive relationship between dengue vector density and rainfall. Japanese Encephalitis also another serious vector borne disease in India. A *Culex* mosquitoes (*Cx. tritaeniorhynchus*, *Cx. pseudovishnui*, *Cx. whitmorei*, *Cx. Gelidus* etc..) play main responsible for spread in this disease to human. The results showed (fig no 7, 8 & 9) eastern parts of Indian states are recorded most of the cases and were seems to increasing trend. To control this disease, we necessity to be focus on current agricultural practices, water management systems and human behavior patterns in the regions. Objective of the study is to understand the current situation of major vector borne diseases in India. Vector borne diseases control stands not difficult, when understanding the vector biology, vector control management, awareness of the diseases. To control the vector borne diseases public health departments need to be providing effective surveillance system and conduct the awareness programs to help to control the cases in utmost affected places. Also, educational institutions along with students can create awareness on vector borne disease through people friendly mode of communication like skit, street play, drama and mass media educational intervention, inclusion of lessons in the school curriculum regarding the preventing aspects of mosquito breeding and balancing the man and environment will be encouraging methods of prevention.

## 6. Acknowledgement

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