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Research Article

A Descriptive Study of Japanese Encephalitis in West Bengal, India, Based on Surveillance Data: Changing Pattern Observed in Recent Years

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Abstract: Japanese encephalitis (JE), commonly affects children and is a major cause of acute childhood encephalopathy. Growth of population, intensified rice farming, pig rearing and lack of surveillance are the key factors for transmission of the disease. Although various hospital and laboratory based studies have been conducted on epidemiology of JE in various parts of India including West Bengal, still the need for further research to have a much clear understanding of this disease epidemiology is beyond any question. The present study aimed at determining the Sample Positivity Rate (SPR) and distribution (Time, Place, Person) of JE cases in West Bengal. This descriptive study was conducted over 9 months periods (June 2012 – February 2013), based on surveillance data corresponding to years 2011& 2012, collected from different JE screening Sentinel Laboratories of West Bengal. Confirmation of JE was done by IgM ELISA method. SPR was significantly higher for older age groups. Mean age of JE cases were significantly higher in 2012. Cases were also found consistently in 2011-12 in districts of North Bengal such as Jalpaiguri, Dakshin Dinajpur, Coochbehar etc. Two different peaks were observed in Epi Curve i.e. for northern part, during July - August and for southern part, during October – November. JE has been found to be significantly affecting older age groups as well as people of North Bengal districts of West Bengal in recent years. Also different seasonal pattern has been playing role in transmission of JE in different parts of West Bengal.
Keywords: Japanese Encephalitis, Surveillance data, West Bengal.

INTRODUCTION

Japanese encephalitis (JE), a vector- borne zoonotic viral disease, is caused by a group B arbovirus and transmitted by Culex tritaeniorhynchus mosquitoes. Pigs & ardeid birds are the amplifier hosts in the transmission cycle, while man and horse are the incidental 'dead end hosts' The ratio of overt disease to in-apparent infection varies from 1:300 to 1:1000 [1]. The disease affects the Central Nervous System and can cause severe complications, seizures and even death. The Case Fatality Rate (CFR) of this disease is very high (about 25%) and those who survive may suffer from various degrees of neurological sequeale [2]. Although, all age groups are affected, cases reported from endemic region are mainly from age groups below 15 years. Growth of population, intensified rice farming, pig rearing etc. are the key factors for transmission of the disease [1].

Epidemics of encephalitis were described in Japan from the 1870s onwards [2]. The virus was first isolated in 1935, and has been recognized across Asia since then [3]. In India, the existence of JEV was first reported serologically in 1954 [4]. However, the disease was first recognized in India at Vellore (former North Arcot district, in the state of Tamil Nadu) in 1955 [5]. Since then, epidemics of JE in different states have been recorded [6, 7]. The first major outbreak of JE occurred in 1973 in Bankura & Burdwan districts of West Bengal with about 700 cases and 300 deaths [8]. Subsequently, another outbreak in the same state occurred in 1976 with 307 cases and 126 deaths [8]. Wide spread

outbreaks were reported from Andhra Pradesh, Assam, Karnataka, Tamil Nadu, Uttar Pradesh and West Bengal in l976 [9]. A major outbreak of Japanese Encephalitis was reported from eastern Uttar Pradesh during 2005 resulting in recording of more than 6000 cases and 1500 deaths. This led to a major decision of introduction of vaccine in high endemic areas in 2006. Simultaneously National Vector Borne Disease Control Programme (NVBDCP) developed surveillance and case management guidelines for syndromic reporting of Acute Encephalitis Syndrome (AES) including JE [2].

As per published literature the vaccination programme against JE (live attenuated JE vaccine SA-14-14-2) has been conducted in some districts of West Bengal like Burdwan, Birbhum, Midnapore (West), Howrah and Hooghly, by the State Health Department, Govt. of West Bengal [10, 11], still sporadic JE/AES cases and deaths were continuously being reported in every JE season from the State which proves the endemicity in this state [12].

The increasing numbers of cases are being reported from West Bengal since 2004 [13] but nil/low report in certain years may be attributed to the lack of sound surveillance activity.

The exact burden of JE in West Bengal is still not certainly known since not many published literatures on this topic are presently available. Hence, in this background the present study was conducted to estimate Sample Positivity Rate for JE and to analyze the distribution of JE cases in terms of the time, place and person.

MATERIALS AND METHODS

Study type

This observational descriptive study, was conducted based on surveillance data corresponding to the years 2011 & 2012.

Study period

Study was carried out for 9 months (June 2012 – February 2013).

Study area

The study was undertaken in the state of West Bengal (WB) located at the eastern region of India (lies between23°00'N latitudes and 87°00'E longitudes**)** [14]. The state has an area of 88,752 km^2 [15,16] According to the results of the 2011 national census, West Bengal is the fourth most populous state in India with a population of 91,347,736 (7.55% of India's population) [16].

Agriculture is the main economic source of this state. Except the northern hilly region, other parts of this state are warm and humid for the maximum time of the year. Here summer lasts from mid -March to mid-June; with the temperature ranged from 38^0C to 45^0C. The monsoon arrives by the middle of June and lasts up to September. The agricultural activities are at their peaks during the post-monsoon phase which persists between middle of September to the end of November of the year [17].

Study population

All cases clinically diagnosed as Acute Encephalitis Syndrome (AES) as per Integrated Disease Surveillance Project (IDSP) guideline as well as tested for JE including those confirmed as JE; as reported to State Surveillance Unit, IDSP, West Bengal in 2011 & 2012.

Study setting

State Surveillance Unit, IDSP, West Bengal

Study tools

Secondary data (surveillance data)

Study variables

Sample Positivity Rate (SPR), Age, Sex, Address (District), Date of sample collection (Person, Place and Time distribution).

Study technique

For the Detection of IgM antibody against JEV in serum and/or CSF, M antibody captured Enzyme-linked Immunosorbent Assay (Mac ELISA) was performed as standard confirmatory method by the sentinel laboratories (for JE) as well as ICMR Virus unit in West Bengal. The IgM ELISA method is 100% sensitive and 100% specific [18].

Sample size

1964 cases of AES tested for JE including 228 confirmed JE (surveillance data).

Data collection

Data were obtained, as a part of routine JE surveillance in IDSP, West Bengal, from all JE screening laboratories of the state present during the corresponding period i.e. 3 sentinel sites of the State (School Of Tropical Medicine, Kolkata, Burdwan Medical College, North Bengal Medical College) along with ICMR-Virus Unit, Kolkata .

A set of samples from one of the districts of West Bengal was once sent for JE screening to Centre of Research in Medical Entomology (CRME), Madurai. Results of them were also included in the study in order to ensure representativeness of the data.

Data analysis

Data were analyzed using MS Excel 2007 and SPSS (version 16). Types of Analysis included Proportions and Percentage; Measures of central tendency (mean, median); Measures of dispersion (SD); and Tests of significance (Chi square test, t-test,

Goodness of fit etc). P value<0.05 was considered significant.

Ethical consideration

Anonymous data were considered for analysis. Confidentiality of the data were maintained throughout the study. Finally the approval of institutional ethical committee of All India Institute of Hygiene & Public Health, Kolkata was obtained.

Operational definitions

Sample Positivity Rate

Number of cases whose sample were found reactive for JE / Number of cases whose sample were tested for JE *100.

Acute Encephalitis Syndrome (AES)

Probable Case Definitions as per IDSP [19]

A person of any age with acute onset of fever and any of the following

- Change in mental status (confusion, disorientation, coma, inability to talk)
- New onset of seizures (excluding simple febrile seizures).
- Other early clinical findings like an increase in irritability, somnolence or abnormal behavior greater than that seen with usual febrile illness.

Probable JE (Japanese Encephalitis)

A suspected case that occurs in close geographic and temporal relationship to a laboratory-confirmed case of JE, in the context of an outbreak.

Confirmed JE

A suspect (AES) or probable JE case confirmed by laboratory tests.

RESULTS

SPR for JE

Among 1964 clinically diagnosed cases of AES, 1172 were males (59.67%) and rest 792 (40.33%) were females. Samples of 228 were positive for JE; thus the overall SPR for JE was 11.61%. In 2011, among 839 cases of AES, 140 were positive for JE; the SPR for 2011 was 16.69%. In 2012, among 1125 AES cases, 88 were positive for JE; the SPR for 2012 was 7.82%. SPR was found to be significantly higher in 2011 than in 2012 ($X^2 = 36.80$; df = 1 ,p = 0.000) .

In 2011, SPR was 17.95% and 14.64% among males and females, respectively, whereas in 2012, the corresponding figures were 7.34% and 8.49% respectively. Overall SPR among males (12.03%) was slightly higher than that among females (10.98%), but this difference was not statistically significant($X^2 = 0.5$, df = 1, p = 0.47).

Overall age specific SPR for under 15 years age group was found to be much lower than the SPR in subsequent age groups. Significant association was found between age groups and sample positivity rate; with highest SPR observed in 45 to 60 years age group followed by more than or equal to 60 years age group.In 2012, a gradual rise of SPR was noted across the age groups where SPR in every age group was found to be higher than that of earlier age group ($X^2 = 29.65$, df = 4, p = 0.000) (Table 1).

Person distribution of JE cases

Most of the JE cases belonged to under 15 years age group with a gradual decline in the distribution towards higher age groups. However, comparing the age distribution between two years it was observed that the proportion of cases in the lower age groups (under 15 years and 15 -30 years) has reduced and the proportion of cases in higher age groups has increased in 2012 (Table 2).

We also compared age distribution of JE cases in the present study (corresponds to years 2011 & 2012) with the age distribution of JE cases from 2005 -2010 of ICMR study. Here we considered the distribution of ICMR study as expected for the total number of cases of the current study and thus observed a significant difference with higher proportion of JE cases found in older age group in the current study (Table 3).

Mean age of JE cases of West Bengal was found to be significantly (t = 2.177, df = 214, p = 0.031) higher in 2012 (29.58 years) than in 2011 (23.35 years). Median age of JE cases was also found to be increased in 2012 compared to the previous year. However, following stratification of data as per vaccine coverage status it was revealed that in vaccine covered districts, there was no significant difference between mean age of JE cases between last two years. On the contrary, in vaccine non covered districts, mean age of JE cases was found significantly higher in 2012 (33.92 years) compared to 2011 (25.33 years).

Mean age of JE cases was little higher for females (26.74) than males (24.46) but this difference is not statistically significant (t = 8.00, df = 218, p = 0.42). Median age of JE cases was also found to be more in females (20 years) compared to males (16 years).

Most of the JE cases were males (61.8%) and rest (38.2%) were females. However in 2012, this proportion of male cases reduced from the earlier year (66.4% to 54.5%) with corresponding increase of female cases (33.6% to 45.5%);thus favoring a nearly equal sex distribution. Also no significant difference was observed in the sex distribution of cases between the two years ($X^2 = 3.23$, df = 1, p = 0.072).

Moreover, proportion of JE cases in different age groups were almost similar for both the sexes with maximum proportion observed in under 15 years age group.

Table 1: Age specific Sample Positivity Rate (%) of JE (n=1964)

Age (in years)	2011			2012			Total		
	Tested	JE Positive	Positivity Rate	Tested	JE Positive	Positivity Rate	Tested	JE Positive	Positivity Rate
<15	543	61	11.23	531	29	5.46	1074	90	8.38
15-<30	123	37	30.08	215	17	7.91	338	54	15.98
30-<45	58	14	24.14	143	15	10.49	201	29	14.43
45-<60	52	15	28.85	101	13	12.87	153	28	18.30
>=60	53	11	20.75	70	11	15.71	123	22	17.89
Not specified	10	02	20.00	65	3	4.62	75	5	6.67
Total	839	140	16.69	1125	88	07.82	1964	228	11.61

Overall SPR with Age groups: $X^2 = 29.65$, df = 4, p = 0.000

Table 2: Age (yrs) distribution of JE cases (n =228)

Age group (in years)	2011			2012			Total		
	Number	Percentage	Valid % (n=138)	Number	Percentage	Valid % (n=85)	Number	Percentage	Valid % (n=223)
< 15	61	43.57	44.20	29	32.95	34.12	90	39.47	40.36
15 - < 30	37	26.43	26.81	17	19.32	20.00	54	23.68	24.22
30 - < 45	14	10.00	10.14	15	17.05	17.65	29	12.72	13.00
45 - < 60	15	10.71	10.87	13	14.77	15.29	28	12.28	12.56
> = 60	11	7.86	7.97	11	12.50	12.94	22	9.65	9.87
Not specified	2	1.43		3	3.41		5	2.19	
Total	140	100.00		88	100.00		228	100.00	

Table 3: Chi Square test (for Goodness of fit) for age distribution of JE cases: considering the distribution found in the study of ICMR –Virus unit from 2005 -2010 in West Bengal as Expected (n = 223)

Age group (in years)	Observed N	Expected N	Residual
0 - 10	73	98.0	-25.0
11 -20	52	54.0	-2.0
21-30	20	14.0	6.0
31-40	24	18.0	6.0
41 - 50	22	15.0	7.0
>51	32	24.0	8.0
Total	223		

$X^2 = 16.95$, df = 5, p = 0.005

Distribution of JE according to place

The district wise distribution of positive JE cases during the study period were given in Table 4. Jalpaiguri and Burdwan districts remained to be the two major contributors of JE cases in both the years. Apart from them, Birbhum showed maximum number of JE cases in 2011 and Dakshin Dinajpur and Murshidabad in 2012.

Time distribution of JE cases

Line diagram of time distribution of JE cases of West Bengal showed two distinct peaks, one in the month of July & August i.e late monsoon and another around October - November i.e. early winter. However, earlier peak was found to be much higher than the later (Fig. 1a).

Line diagram of time distribution of JE cases of 6 districts of northern part of West Bengal exhibited the peak in the month of July & August followed by a sharp decline. Most of the cases of these districts were found to be occurring in July & August i.e in the middle part of the year (Fig. 1b).

Line diagram of time distribution of JE cases of 13 districts of southern part of West Bengal showed that cases rose from August onwards and reached a peak in November followed by a steady decline over next few months (Fig. 1 c).

Temperature pattern of West Bengal in 2012 showed similar range of temperature (28 – 36 degree Celsius) in the month of June & September respectively in the district of northern & southern part of West Bengal.

Table 4: District wise distribution of JE cases

District	2011			2012		
	Number of JE cases	Percentage of JE cases	Valid % (n= 125)	Number of JE cases	Percentage of JE cases	Valid % (n= 83)
Bankura	3	2.14	2.40	1	1.14	1.20
Birbhum	10	7.14	8.00	4	4.55	4.82
Burdwan	17	12.14	13.60	12	13.64	14.46
Coochbehar	8	5.71	6.40	4	4.55	4.82
D.Dinajpur	6	4.29	4.80	7	7.95	8.43
Darjeeling	3	2.14	2.40	3	3.41	3.61
Hooghly	8	5.71	6.40	1	1.14	1.20
Howrah	5	3.57	4.00	5	5.68	6.02
Jalpaiguri	14	10.00	11.20	27	30.68	32.53
Kolkata	8	5.71	6.40	4	4.55	4.82
Malda	8	5.71	6.40	2	2.27	2.41
Murshidabad	7	5.00	5.60	7	7.95	8.43
Nadia	6	4.29	4.80	2	2.27	2.41
Purba Medinipur	7	5.00	5.60	1	1.14	1.20
Paschim Medinipur	6	4.29	4.80	0	0.00	0.00
Purulia	1	0.71	0.80	0	0.00	0.00
North 24 PGs	4	2.86	3.20	2	2.27	2.41
South 24 PGs	2	1.43	1.60	1	1.14	1.20
Uttar Dinajpur	2	1.43	1.60	0	0.00	0
Non specified	11	7.86		1	1.14	
Other state	4	2.86		4	4.55	
Total	140	100		88	100	

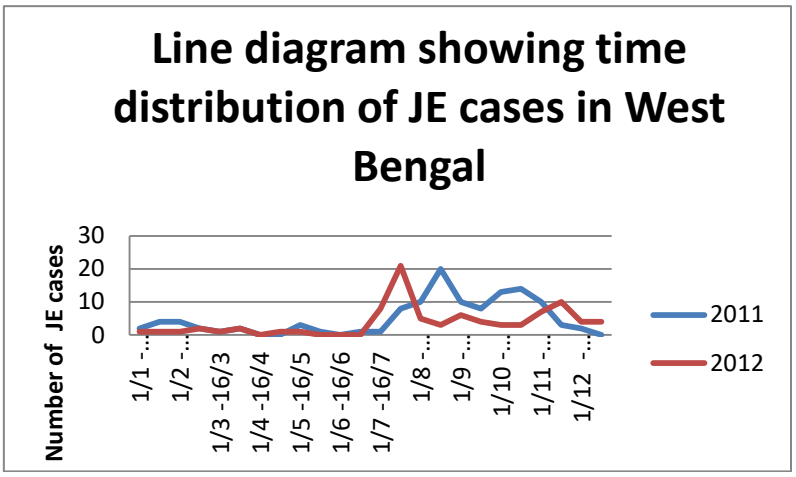

Fig. 1a: Line diagram showing time distribution of JE cases in West Bengal: showing two distinct peaks, one in the month of July & August (late monsoon) and another around October - November (early winter).

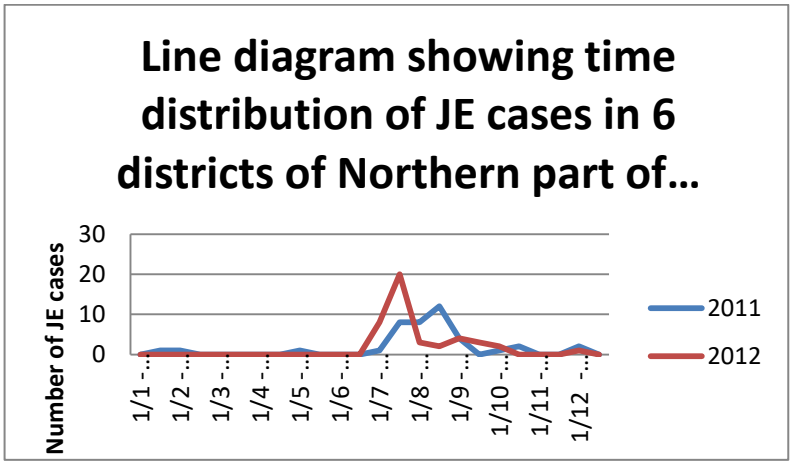

Fig. 1b: Line diagram showing time distribution of JE cases in 6 districts of Northern part of West Bengal: showing that in the 6 districts of northern part of West Bengal, cases reached peak in the month of July & August followed by a sharp decline

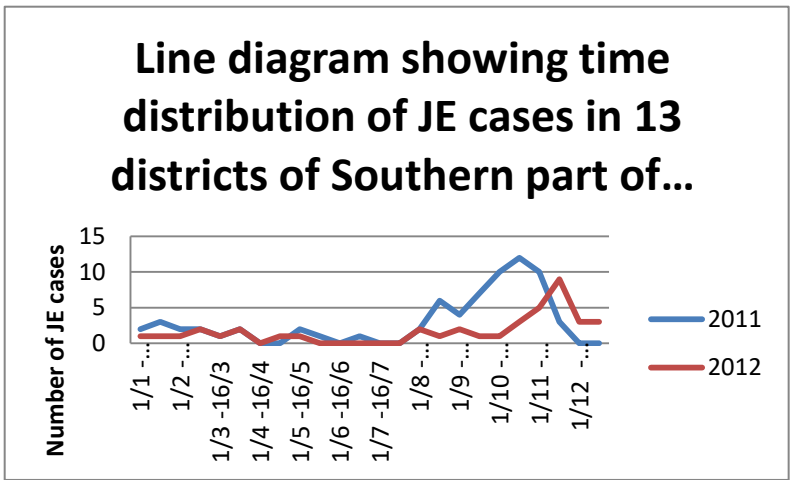

Fig. 1c: Line diagram showing time distribution of JE cases in 13 districts of Southern part of West Bengal: showing that in the 13 districts of southern part of West Bengal, cases started to rise from August onwards and reached a peak in November followed by a steady decline over next few months up to march

DISCUSSION

In this study, the role of epidemiological features involved in JE were well documented.

Sample Positivity Rate

In the present study overall Sample Positivity Rate for JE was 11.61%; which was corroborative with the findings of the study conducted by Bandyopadhyay *et al*. at Virology laboratory at the Calcutta School of Tropical Medicine, West Bengal in their 2 years study (2011-12) (12.21%) [20]. However it was quite lower than the findings of studies conducted by Sarkar *et al*. at ICMR ((Indian Council of Medical Research)Virus Unit of , in their 5 years study (2005 – 2010) (27.00%) [21]; Taraphdar *et al*. at ICMR Virus Unit of Kolkata, , in their 6 years study (2005 – 2011) (35.14%) [22]; Anuradha *et al*. at Paediatric department at VIMS hospital Bellary, Karnataka (23.17%) [23] and Shreshtra *et al*. at Pediatric ward of Patan hospital., Nepal in their 2 years study (2006-07) (17.7%) [24]. On the contrary, study conducted by Gunasekaran *et al*. at King Institute of Preventive Medicine & Research (KIPM & R), Chennai, Tamil Nadu in their 3 years study(2007-09) revealed the SPR was as low as 4.9% [25].

In this study, a significantly higher Sample Positivity Rate was seen among older age groups; which was in contradiction to the existing knowledge that JE is predominantly a childhood disease [20-22].

Although SPR was higher for males in our study, but this difference was not statistically significant; which was exactly in tune with the study at Calcutta School of Tropical Medicine [20], Indian Council of Medical Research of Kolkata [21], ICMR Virus Unit of Kolkata [22], VIMS hospital Bellary [23] and KIPM & R, Chennai [25]. In contrast, a female preponderance was noted in study at Patan Hospital, Nepal [24].

Person distribution

Although, JE cases have been observed from all the age groups in the present study, highest numbers

of JE positive cases recorded among 0-15 years with a gradual decline towards higher age groups. This finding was in accordance with many previous studies; such as study by Bandyopadhyay et al (48.21% & 61.11% below 20 years of age in 2011 & 2012, respectively) [20], Sarkar *et al*., (44.0% belonged to 0 - 10 years age group & 24.0% were in the age group of 11 - 20 years) [21], Taraphdar *et al*. (59.10% cases were upto 20 years of age) [22], Anuradha *et al*. (maximum male & female cases were in the age group of 7- 9 years & 1-3 years respectively) [23], Gunasekaran *et al*. (82% under 12 years of age) [25] and Bista *et al*. (50% occurred below 15 years of age) [26].

Although maximum JE cases were below 15 years of age group, earlier we have found a higher age specific sample positivity rate for older age groups. It simply indicates much more samples were tested in younger ages which yielded so many JE cases with a lower sample positivity rate compared to adult cases. This might be a probable indication of age –shifting towards higher side.

Also comparing this age distribution of JE cases in the present study (2011 & 2012) with the age distribution of JE cases from 2005 -2010 by ICMR Virus unit of Kolkata [21], significant difference was observed; proportion of cases in higher age groups found increased in the current study. This finding again indicated the possibility of recent age shifting. In the study by Taraphdar *et al*., proportion of JE cases below 20 years were around 90% in 2005 & 2006 but reduced to around 40 -50% in subsequent years which also supports such possibility [22].

Most of the JE cases were males and the male to female ratio was 1.51 : 1. Many other studies revealed male predominance such as at Calcutta School of Tropical Medicine (1.64:1) [20], ICMR, Kolkata (1.36:1) [21], ICMR, Virus Unit (1.50:1) [22], Bellary(1.48:1) [23] and Chennai (male : female =1.64:1) [25].

Place distribution

In the present study, districts of northern part of West Bengal like Jalpaiguri , Dakshin Dinajpur, Coochbehar, Darjeeling, Malda etc showed constant presence of JE cases in both the years (2011 & 2012) along with endemic districts of southern part such as Burdwan, Birbhum, Hoogly, Howrah, etc. Taraphdar *et al*. [22] also supported this view; in their study, occurrence of JE cases in 2011 were recorded in the districts of Jalpaiguri and Coochbehar which are located in hilly and cold climatic regions. According to them, these two districts are adjacent to state of Assam, where an outbreak of JEV had been recorded in July 2011.Possibly the JE affected people of those two districts were infected by vector mosquitoes that migrated from the neighboring state of Assam. Study of Bista *et al*. [26] also stated that although JE was endemic mainly in tropical climate areas, existence and proliferation of encephalitis causing viruses in temperate and cold climates of hills and valleys are possible.

In contrast, study of Bandyopadhyay *et al*. [20] and Sarkar *et al*. [21] showed the absence of JE cases, in the northern region which is surrounded by hills and shows moderately cold climatic condition. According to them, rain water is less likely to stagnate in the hill areas, reducing the breeding opportunities of the vector mosquito.

Time distribution

In our study, Epi curve of JE cases of West Bengal showed two distinct peaks, one in the month of July & August (late monsoon) and another around October - November (early winter).

In the 6 districts of northern part of West Bengal, cases reached peak in the month of July & August followed by a sharp decline. Nepal study [26] revealed an upsurge of cases after the rainy season (Nepal is in geographical vicinity to as well as having a climatic condition similar to the districts of North Bengal) where cases start to appear in the month of April - May and reached its peak during late August to early September and start to decline from October. Strangely, as per Chennai study [25] also, majority of the cases were reported soon after monsoon, i.e. peak during late August to early September and start to decline from October.

Similarly, in the 13 districts of southern part of West Bengal, cases started to rise from August onwards and reached a peak in November followed by a steady decline over next few months up to march. This clearly indicates two distinct time pattern of JE cases in northern and Southern Bengal.

West Bengal studies [20, 22] demonstrated that large number of JE cases occurred during rainy and post rainy season (June to November). According of to the study of Arindam Sarkar *et al*. [21], in West Bengal, JE cases reaches peak in September, followed by October and November. Since they found most of the cases from southern part, this could be the reason that the peak time found in their study somewhat matched with that discussed by us for southern districts. As per study at Bellary, Karnataka, the cases started from July, reached peak in November (rainy season followed by winter season)and then decline; no cases seen from January to June [23].

Temparature pattern of West Bengal in 2012 showed similar range of temperature (28 – 36 degree celcius) in the month of June & September respectively in the district of North Bengal & South Bengal. Considering the peak in Epi curve in July & August for cases of North Bengal and in October – November for

cases of South Bengal, it can be stated that vector breeding started in June and September i.e. around one to one and half months before the peak, respectively in these two regions. Hence a temperature favorable for breeding of culex in these regions probably explains the difference in the time pattern of JE cases.

Limitations

We did not take into consideration some important socio-demographic variables like location of the residence, type of house, educational status, economic status etc.

CONCLUSION

The present study added the followings, over and above the previous knowledge:

- JE is a predominant infection among children as well as among adult. A possible increase in mean age of infection, particularly in vaccine non covered districts has been found. Overall a probable shift in age distribution in recent years has been observed.
- Different peaks have been observed in northern and southern part of West Bengal possibly due to different temperature pattern.
- JE cases have been found in the districts of Northern part of West Bengal like Jalpaiguri, Dakshin Dinajpur, Coachbihar etc consistently in 2011 & 2012. With reference to the low endemicity reported in earlier studies, JE status appears to have changed in those districts since 2011.

Recommendations

Active surveillance of JE cases is still warranted in order to be vigilant about any new genotype introduction in the endemic districts or to find out any spread into newer geographical areas.

REFERENCES

1. Park K; Epidemiology of communicable diseases. Park‘s Textbook of Preventive and Social Medicine. Chapter 5, 22nd edition, M/s Banarsidas Bhanot Publishers, Jabalpur, 2013: 259-262.
2. Operational Guidelines; National Programme for Prevention and Control of Japanese Encephalitis/ Acute Encephalitis Syndrome. Government of India, Ministry of Health & Family Welfare, Directorate General of Health Services, National Vector Borne Disease Control Programme, 2014:1-3.
3. Solomon T, Ni H, Beasley DW, Ekkelenkamp M, Cardosa MJ, Barrett AD; Origin and evolution of Japanese encephalitis virus in southeast Asia. J Virol., 2003; 77(5): 3091-3098.
4. Smithburn KC, Kerr JA, Gatne PB; Neutralising antibodies against certain viruses in the sera of residents of India. J Immunol, 1954; 72(4): 248–257.
5. Namachivayam V, Umayal K; Japanese Encephalitis, Proceedings of National Conference. New Delhi, Indian Council of Medical Research, 1982: 30–33.
6. Dhillon GP, Raina VK; Epidemiology of Japanese encephalitis in context with Indian scenario. Indian J Med Assoc, 2008; 106(10): 660–663.
7. Kabilan L, Rajendran R, Arunachalam N, Ramesh S, Srinivasan S, Samuel PP et al; Japanese encephalitis in India: an overview. Indian J Pediatr., 2004; 71(7): 609–615.
8. Saxena V, Dhole TN; Preventive strategies for frequent outbreaks of Japanese encephalitis inNorthern India J. Biosci., 2008; 33(4): 505–514.
9. Dinesh DS, Pandey K, Das VNR, Topno RK, Kesari S, Kumar V et al; Possible factors causing Acute Encephalitis Syndrome outbreak in Bihar, India. Int J Curr Microbiol App Sci., 2013; 2(12): 531-538.
10. State Bureau of Health Intelligence; Health on the March 2008-09. Director of Health Science, Government of West Bengal, 2009:139-140.
11. Sarkar A, Taraphdar D, Mukhopadhyay SK, Chakrabarti S, Chatterjee S; Serological and molecular diagnosis of Japanese encephalitis reveals an increasing public health problem in the state of West Bengal, India. Trans R Soc Trop Med Hyg., 2012; 106(1): 15–19.
12. Programme Implementation Plan 2011-12; National Rural Health Mission/Health and Family Welfare Department, West Bengal. Disease control programme, scheme/program under national rural health mission. Available from http://pipnrhm mohfw.nic.in/index_files/non_high_focus_large/westbengal/4d.pdf
13. Ministry of Health and Family Welfare; Operational Guide for Japanese Encephalitis Vaccination in India. Immunization Division, Department of Family Welfare, MoHFW, GOI. 2010 Available from http://www.iapcoi.com/hp/Dec25th/Guidelines-Japanese-Encephalitis,MoHFW,September,2010[2].pdf
14. Latitude and Longitude of West Bengal; Maps of India. Available fromhttp://www.mapsofindia.com/lat_long/westbengal/
15. West Bengal Maps; Available from http://www.mapsofindia.com/maps/westbengal/
16. Govt. of India; Census Data Summary 2011. States at a glance, Government of India, Ministry of Home Affairs, Office of the Registrar General & Census Commissioner.

17. Climate of West Bengal; Maps of India. Available from http://www.mapsofindia.com/west-bengal/geography/climate.html
18. Japanese Encephalitis IgM ELISA Kit. Available from http://www.rapidtest.com/index.php?i=Japanese-Encephalitis-IgM-ELISA-kit&id=619&cat=17
19. National Centre for Disease Control. New Delhi; Integrated Disease Surveillance Project. Training manual for medical officers for hospital based disease surveillance. 2nd edition, 2006: 23. Available from http://www.idsp.nic.in/idsp/usermanaul/manual_for_MO.pdf
20. Bandyopadhyay B, Bhattacharyya I, Adhikary S, Mondal S, Konar J, Dawar N et al; Incidence of Japanese Encephalitis among Acute Encephalitis Syndrome Cases in West Bengal, India. Bio Med Research International, 2013; 2013(1):1-5.
21. Sarkar A, Taraphdar D, Mukhopadhyay BB, Kumar M, Mukhopadhyay SK, Chatterjee S; Influence of socio-economic status and environmental factors on serologically diagnosed Japanese encephalitis cases in the state of West Bengal, India during 2005-2010. Health, 2012; 4(1): 6-12.
22. Taraphdar D, Sarkar A, Mukhopadhyay BB, Chakraborty D, Khatun T, Chatterjee S; Increasing trend of Japanese encephalitis cases in West Bengal, India – a threat to paediatric population. Asian Pacific Journal of Tropical Disease, 2012; 2(5): 358-361.
23. Anuradha SK , Surekha YA , Sathyanarayan MS , Suresh S , Satish P , Mariraj J et al; Epidemiological aspects of japanese encephalitis in Bellary, Karnataka, India. Int J Biol Med Res., 2011; 2(3): 691-695.
24. Shrestha SR, Awale P, Neupane S, Adikari N, Yadav BK; Japanese encephalitis in children admitted at Patan hospital. J Nepal Paediatr Soc., 2009; 29: 17–21.
25. Gunasekaran P, Kaveri K, Arunagiri K, Mohana S, Kiruba R, Senthil V et al; Japanese encephalitis in Tamil Nadu (2007-2009). Indian J Med Res., 2012; 135(5): 680–682.
26. Bista MB, Shrestha JM; Epidemiological situation of Japanese encephalitis in Nepal. J Nepal Med Assoc., 2005; 44(158): 51–56.