



## A REPORT ON OUTBREAK INVESTIGATION OF DENGUE FEVER IN ROHTAS DISTRICT, BIHAR IN 2013: IMPLICATIONS FOR CONTROL

### Microbiology

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### ABSTRACT

Dengue outbreak in Rohtas district in 2013 was investigated to determine the causes of current outbreak and to recommend remedial measures to overcome the current outbreak and prevent occurrence of outbreaks in future. Daily reporting of cases was ensured from the district in prescribed format. Epidemiological, entomological and environmental investigations in the affected areas were done to find out the factors contributing to the occurrence of the outbreak. Approximately, 1160 cases of dengue fever were reported from Rohtas district from 26 July till 14 Nov 2013. Age group affected most was 11-20 (32%)>21-30 (26%)>31-40 (19%). Males (66%) were more affected than females (34%). 11 out of 19 blocks were affected. Two Blocks viz: Kochas (1101 case) and Dinara (22 case) were more affected. Approximately, 64 and 9 villages each in Block Kochas and Dinara were affected respectively. In Block Kochas incidence of the disease was more in village Kochas (510 case)> Parasthua (41 case) > Gaura (18 case) while in Block Dinara incidence of the disease was more in village Geuda (3 case)> Harihardihara (3 case)> Dehri-on-Sone (2 case). 73% of clinical samples were NS1 Ag positive while 27% were IgM ELISA positive. Entomological findings confirmed the presence of Aedine vector in the affected areas. Tyres were identified as the major aedine larval breeding site. Water storage in containers for long time was common in the affected areas. Finding confirms the factors leading to the present outbreak and highlights risk factors and control strategies to prevent future outbreak in the region. Community support and participation is also crucial for the prevention of future outbreaks and improving the health and well being of population in the districts.

### KEYWORDS

Dengue, Outbreak, House index, Briteau index, container index, NS1, IgM ELISA

#### Introduction:

Dengue fever (DF) is a mosquito-borne viral infection which is emerging fast in terms of mortality and morbidity in humans worldwide, particularly in tropical and subtropical countries. <sup>(1)</sup> Dengue fever is an acute febrile illness of 2-7 days duration with two or more of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations, leucopenia <sup>(2,3)</sup> and with one or more of the following: Supportive serology (reciprocal haemagglutination-inhibition antibody titer, comparable IgG EIA titre or positive IgM antibody test in late acute or convalescent-phase serum specimen) and epidemiologically linked with a confirmed case of dengue fever (occurrence at same location and time as other confirmed cases of dengue fever).

*Aedes aegypti*, the main vector species of dengue fever/dengue haemorrhagic fever (DHF) is commonly found in urban and peri-urban areas which can be attributed to the availability of breeding sites such as water storage containers due to poor management of water and limited supply of drinking water, non degradable tyres, long lasting plastic containers and ineffective community participation in eliminating the breeding <sup>(4,5)</sup>. In India, dengue fever was recognized as a classical disease with a high morbidity but no mortality and being mainly restricted to urban areas of the country (Pandya, 1982; Mohan, 1987; Yadava and Narasimham, 1992). However, during the past few years, the frequency of dengue haemorrhagic fever (DHF) outbreaks has increased (Bandyopadhyay et al., 1996; Ramachandran et al., 1990). Earlier, the disease was mainly restricted to urban and semi-urban areas of the country because of the availability of favourable breeding sites of the mosquito vector species, *A. aegypti*, and rural areas were reported to be largely free of the vector species (Yadava and Narasimham, 1992). Introduction of safe drinking water in rural areas has led to water storage practices providing breeding grounds for vectors (Ramachandran et al., 1990; Rakesh et al., 1997). In Bihar outbreaks of Dengue fever have been reported in recent years. Outbreaks have been reported from the rural as well as urban areas. <sup>(6,7)</sup>

#### Specific Objective:

To review and assess the situation of Dengue fever outbreak in Rohtas district of Bihar, to determine the causes of current outbreak, to conduct an epidemiological and also entomological survey in some of the affected areas of Rohtas, to assess the environmental and sociological factors contributing to the abundance of Dengue vector

and to recommend remedial measures to overcome the current outbreak and prevent occurrence of outbreaks in future.

#### Materials and Methods:

A wide epidemiological, environmental and entomological investigation was carried out in affected areas of Rohtas district in August 2013. The epidemiological studies included the study of data source regarding blood samples for serology, clinical profile of patients, age distribution of patients, and clinical symptoms of the disease. The entomological investigations included larval survey for the study of breeding sites of *A. aegypti* habitats and calculation of House, Container and Breteau indices. Environmental investigations included examination of water storage practices, environmental investigation, knowledge, attitude & practices of the community were also analyzed as per pre-planned questionnaire. Discussion with the District authorities and medical and paramedical staff was done to know the background information of the affected areas, genesis of outbreak; investigations carried out so far and control measures undertaken. Discussion was also done with the physicians who treated the cases about the clinical presentation of cases, results of laboratory investigations and outcome of cases. Interview and clinical examination of some of the cases were done. Visit to affected areas was made. Rapid fever survey by house to house visit and collection of sera samples from suspected cases for Dengue IgM test was done.

#### Epidemiological description of Rohtas:

Rohtas district was formed on 10th November 1972. Latitudinal extent of the district is 24-30" to 25-20" (north) while the longitudinal extent is 83-14" to 83-20" (east). Total population of the district is 24,50,748. Population density (per sq km) is 636. Decennial population growth rate (per one thousand) based on 1991-2001 census is 27.71. Area of Rohtas district is 3847.72 sq km while its height from sea level is 107.78. Total rural population of the district is more (2103116) than the urban population (347632). Total number of villages in the district is 2088 while total number of urban areas is only 6. Illiterate population is more (1245461) than literate population (1205287). No of subdivision in the district is 3 while the number of blocks is 19, panchayats is 244 & the number of villages is 244. The district is basically an agricultural area. Area of agricultural land (hectares) is 242832. Total number of agricultural labourers is 153371. Normal rainfall in mm in the district is 1076.8. Maximum temperature is 45 degree Celsius while minimum is 10 degree Celsius. Heavy rainfall is experienced during the months

of July, August and September followed by cooler winter months. Summer months are hot with high humidity.

**Epidemiological observations & results:** is based on data collected from Integrated Disease Surveillance Programme (IDSP) reporting units, their detailed analysis as well as questionnaire on clinical signs & symptoms with the patients & their relatives as well as health officials.

The district has been reporting Dengue cases based on presumptive surveillance over the years, however not a single case of dengue has been reported by the district till July 2013 before the start of the present outbreak. The district also reported an outbreak of Dengue 26<sup>th</sup> July 2013 that involved 1 case & 1 death. Total 423 cases of Dengue have been reported from Rohtas from 26<sup>th</sup> July till 30<sup>th</sup> Aug 2013. The index case was reported on 26<sup>th</sup> July 2013. Total 5 blocks viz: Dinara, Karghar, Kochas, Sasaram and Suryapura are affected with Dengue. Block Kochas was the most affected with 415 cases. Approximately, 80 villages in block Kochas were affected due to Dengue. The Attack rate of Dengue in Kochas was 0.94 while for other blocks attack rate was insignificant. The disease has afflicted almost all the age group but the incidence is more in the age group 11-20 (36%)>21-30 (26%)>31-40 (16%). Males (64%) are more affected than females (36%). The most common clinical features shown by Dengue patients were fever, headache and retro- orbital pain. No patients surveyed suffered from rash. Out of the 423 cases, 85% of the patients were NS1 Ag positive while only 18 % were IgM, IgG or IgM+IgG positive. Lots of construction activities were seen in the village Katiyara and Sorathi and they might be in transitional stage from rural to semi-urban. Multi-storeyed buildings were seen and surveyed for checking the larval breeding areas. History of travel outside the locality was not significant. The general weather condition during the last one month was hot and humid followed by spells of rain. Given the large population continuous supply of piped water is not available in the district. As a result of the intermittent supply, water storage practices mainly in big cement and plastic tanks are common. Detailed results of the epidemiological studies is presented in Figures and Table: A (1-5)

**Entomological Observations & results:** is based on adult mosquitoes collected by Suction tube method & aspirator torch in indoors in Human Dwellings during day hours. Larval sampling was done using various indices like House, Container and Briteau index. All the domestic and peri-domestic premises were searched. Containers such as tyres, plastic materials, earthen pots, tin items, cement tanks, coolers & other miscellaneous items were thoroughly searched for mosquito breeding sites.

20 house each in 2 villages of Block Kochas viz: Katiyara & Sorathi was surveyed for the presence of aedine larva in several water storage containers. Out of 20 houses, 17 and 12 houses were positive for aedine larvae in village Katiyara and Sorathi respectively. House Index (HI), Container Index (CI) and Briteau Index (BI) in was 85, 80 and 180 in village Katiyara and 60, 54 and 95 in village Sorathi. Village Katiyara was at greater risk due to dengue than Sorathi. Different species of mosquitoes were collected from indoor habitats at noon hours, But only *aedes* mosquito per man hour density has been taken into account due to its co-relation with the disease dengue. Per Man hour density of *aedes* was 57 in village Katiyara and 34 in village Sorathi. Maximum number of larval collection was done from Tyres (61% & 63%)> Cement (17% & 16%) > Earthen containers (14% & 11%) in village Katiyara and Sorathi respectively. Detailed results of entomological study is presented in Figures and Table: B (a-c)

**Environmental & Sociological Observations and Results:** are based on standard pre-planned questionnaire & interview with the patients & their relatives as well as community members residing in visited villages.

Most of the affected population belonged to middle socio-economic strata, with most of the houses being semi-pucca/ or pucca-category. Majority of them belonged to agricultural labour community. Lots of construction activities were going on in these villages. Multi-storied buildings were also seen in these villages where water storage practices were most common. Many residents owned trucks for their living. We could see large discarded truck tyres around the households visited, that provided a major breeding source for the *aedes* mosquitoes. Majority of the population were illiterate and unaware of the cause of the disease. Awareness regarding disease control &

prevention was also very less. Due to lack of continuous water supply in the affected areas, water storage practices in several containers for long duration were very peculiar. Most of the affected areas were very dirty & no proper waste management was being done. Detailed results of environmental and sociological study is presented in Figures and Table: C (i-iii)

### Conclusion

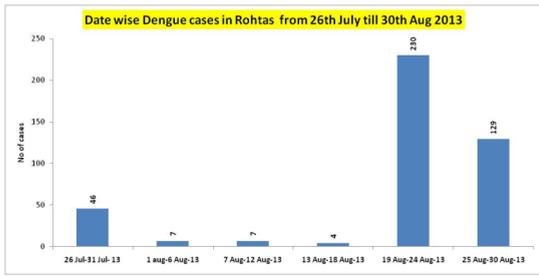
Approximately 423 cases of Dengue have been reported from Rohtas from 26<sup>th</sup> July till 30<sup>th</sup> Aug 2013. Total five blocks are affected but the block Kochas is most affected in which around 80 villages are affected. Disease has afflicted almost all age groups but the incidence is more in 11-20 age group. Vector and larval surveillance in the affected areas were positive. Per Man Hour density of *Aedes aegypti* was high (25 & 20) in village Katiyara & Sorathi respectively. High House Index in various areas of two affected villages remain at significant risk of outbreaks in the future if appropriate control measures are not put in place. Around 70% of the population was aware about the term Dengue, however knowledge about various aspects were lacking. Around 80% of the population stored water at home. Only 10% of the population cleaned/changed the water stored in domestic or peri-domestic containers. Community support and participation is also crucial for the prevention of future outbreaks and improving the health and well being of population in the districts.

### Recommendations

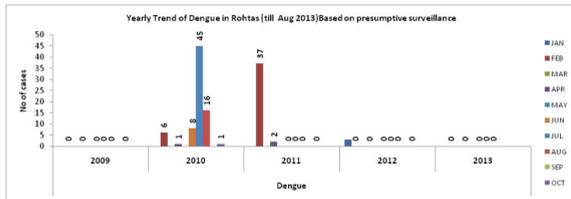
- 1) Strengthening of the surveillance, particularly fever and entomological surveillance, along with appropriate response is important. Surveillance should also be strengthened in other unaffected areas to ensure appropriate and timely response. Data analysis work should be carried out on regular basis to generate the Early Warning Signals of diseases. Coordination and data sharing between District Surveillance Unit, (IDSP) & District Programme officers of Disease Control Programme (Vector Borne Diseases) must be done on regular basis to contain outbreaks.
- 2) Sensitization of medical and para-medical personnel in the government as well as private sectors needs to be undertaken for appropriate and timely management of cases.
- 3) District level coordination meeting comprising of local community leaders of affected areas and other departments like municipality and other stakeholders should be called to spread awareness regarding the disease & to prevent future outbreaks.
- 4) Medical camps in affected areas would be beneficial as this would also ensure community awareness.
- 5) Malathion fogging in large areas having concentration of cases or areas with higher vector density, must be undertaken on a priority basis.
- 6) Anti-larval measures with Temephos (Abate) (1ppm) may be put in big drums and containers from which water cannot be discarded or thrown away.
- 7) Vector & larval surveillance should be carried out throughout the year to map the vector density & larval breeding sites. For this VBD consultant should be made well equipped.
- 8) Awareness of Community through IEC, IPC & BCC must be done for success of intervention methods. This should cover following aspects:
  - A) Cause and transmission of Dengue fever, about the vector breeding places, specifically household container breeding and biting habits, etc, symptoms of the disease, management including treatment of the cases, and community measures for prevention of breeding and to prevent man-mosquito contact.
  - B) Vector control measures like intensification of entomological surveillance in the area on regular basis, emptying the containers on weekly basis and scrubbing & drying them when not in use.
- 9) All paces adjoining the affected areas where a case of Dengue has been recorded should be made alert & an eye on all the fever cases should be kept for timely referral & cases management and to prevent future outbreak.
- 10) Possibility of providing regular water supply to residential areas.
- 11) More number of laboratories should be strengthened to support for early diagnosis of Dengue fever and for blood collection from suspected cases.
- 12) Waste management should be properly planned by District Health Authorities & Municipality.

**A) EPIDEMIOLOGICAL INTERPRETATIONS & RESULTS:**

**1) Time wise distribution of Dengue cases in Rohtas**

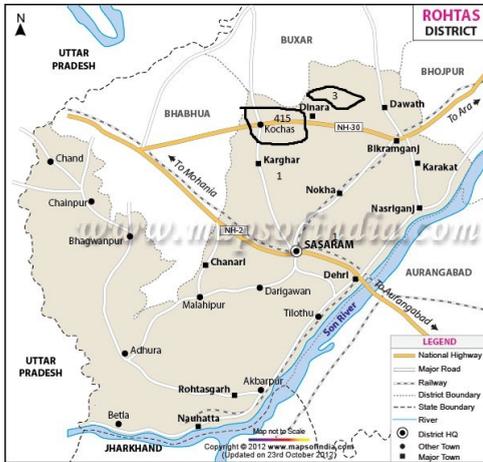


**2) Yearly trend of Dengue cases in Rohtas**



**3) Place distribution of Dengue cases in Rohtas**

**A) Map of Rohtas showing affected blocks**



**4) Block wise summary of Dengue cases in Rohtas**

No of blocks affected with Dengue in Rohtas/(Total cases from all the affected blocks)	5 (423)
Name of the affected blocks	Dinara, Karghar, Kochas, Sasaram and Suryapura
No of villages affected in Block Kochas/(No of cases reported)	Approx. 80 villages (415)
No of villages affected in Block Karghar/(No of cases reported)	1(1)
No of villages affected in Block Dinara/(No of cases reported)	2 (3)
No of villages affected in Block Sasaram/(No of cases reported)	1 (1)
No of villages affected in Block Suryapura/(No of cases reported)	1 (1)

**5) Person distribution of Dengue cases in Rohtas**

**a) Clinical presentation of Dengue fever**

Clinical symptom	Affected (%)
Fever	50 (100)
Headache	50 (100)
Myalgia	30 (60)
Retro-orbital pain	50 (100)
Nausea/vomiting	12 (24)
Diarrhoea	5 (10)
Pain abdomen	5 (10)
Petechiae/rash	1 (2)
Dark coloured stool (malaena)	3 (6)
Bleeding gums	0 (0)

**b) Age group & Sex distribution of Dengue cases in Rohtas**

Age group	Frequency	%
0-10	44	11
11-20	146	36
21-30	106	26
31-40	64	16
41-50	30	7
51-60	17	4
61-70	3	0.7
71+	0	0
Total	410	
Data NA	13	
Sex	Frequency	%
Female	154	36
Male	269	64
Total	423	

**c) Serological status of Dengue in Rohtas**

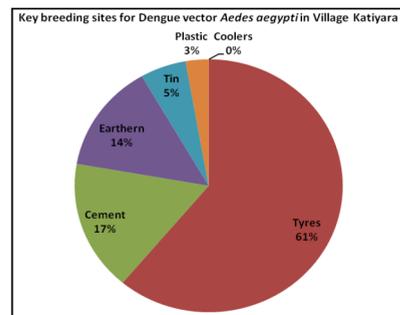
Test	Number	Percentage
IgG+IgM	1	0.2
IgG+NSI	1	0.2
IgM	61	15
NSI	360	85
Total	423	

**B) ENTOMOLOGICAL INTERPRETATIONS & RESULTS**

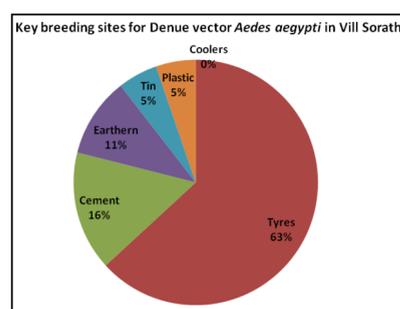
**a) Results of Aedine larval survey in Village Katiyara & Sorathi**

S NO	Larval Indexes	Village Katiyara		Village Sorathi	
		Results	PMHD <i>Aedes aegypti</i>	Results	PMHD <i>Aedes aegypti</i>
1	Houses surveyed	20	57	20	34
2	Positive for Aedes breeding	17		12	
3	House Index (percentage of house/premises positive)	85		60	
4	Containers searched	45		35	
5	Containers positive	36		19	
6	Container index (percentage of containers infested) *In examining the containers, only those having water have counted)	80		54	
7	Briteau Index (No. of containers positive/ No. of houses inspected x 100)	180		95	

**b) (i) Key breeding sites of Aedes in village Katiyara**



**ii) Key breeding sites of Aedes in village Sorathi**



c) Risk Factors in village Katiyara for Dengue transmission		
Risk Factor for Dengue transmission in Rohtas		
Potential Risk	Vill:Katiyara	Vill:Sorathi
Wet containers in 20 houses	45	35
Avg wet container/house	2.25	1.75
Real Risk	Vill:Katiyara	Vill:Sorathi
Vector infested containers	36	19
Houses positive for breeding	17	12
Avg positive container/house	1.8	~1
Avg positive container/ infested house	2.11	1.6

C) SOCIOLOGICAL & ENVIRONMENTAL INTERPRETATIONS & RESULTS

D) Number of people interviewed (n=50) (includes survey of both Katiyara and Sorathi villages, Rohtas)			
S NO	Knowledge	Yes (%)	No (%)
1	Knowledge about Dengue	35 (70)	15 (30)
2	Knowledge about signs & symptoms of Dengue	30 (60)	20 (40)
3	Knowledge about spread of Dengue	32 (64)	18 (36)
4	Knowledge about Dengue vector	15 (30)	35 (70)
5	Knowledge about prevention of Dengue	17 (34)	33 (66)
6	Knowledge about Dengue vector breeding in discarded water storage containers/ornamental plant containers	5 (10)	45 (90)
Attitudes & Practice			
1	Person feels mosquito bite during day time	45 (90)	5 (10)
2	Cover overhead water containers/other containers	30 (60)	20 (40)
3	Involved themselves in Govt efforts	25 (50)	25 (50)
4	Use of repellent in day time	0	50 (100)
5	Wear full cloth in day time	20 (40)	30 (60)
6	Cleaning of water coolers/other containers on weekly basis	10 (20)	40 (80)
7	Store water at home	40 (80)	10 (20)

ii) DENGUE OUTBREAKS REPORTED IN ROHTAS IN 2012

Ministry of Health & Family Welfare, IDSP, GoI  
STATE HEALTH SOCIETY, BIHAR  
Disease Outbreak Report Responded & Investigated by IDSP, ROHTAS in 2012, Bihar for Decision Makers

District	Disease/ Syndrome	Area Affected(Block, PHC, Sub-center, Village	No of Cases	No of Deaths	Date of Outbreak	Population of Affected Area
ROHTAS	Dengue	PHC- Chenari, Viull- Sadokhar Rohtas	1	0	1/11/2012	900
	Dengue	Block- Akorhigola PHC- Akorhigola vill- Mahadalit Tola, Akorhigola	1	1	26/10/2012	600
	Dengue	Near Navjevan Hospital Sasaram rohtas PHC- Sasaram Dist- rohtas	1	0	26/10/2012	200
	Dengue	Vill- Kanchanpur Sasaram	1	1	15/10/2012	15000
	Dengue	PHC- Dehri, Moh- Neel Kothi	1	0	26/10/2012	5000
	Dengue	Moh- Neel kothi, PHC- Dehri On Sone	1	0	4/11/2012	5000
	Dengue	PHC- Dehri, Moh- Neel Kothi	1	0	1/11/2012	5000
	Dengue	Vill- Debhariya Rampur, PHC- Kochas	1	0	4/11/2012	750
	Dengue	Moh- Dehri Town, PHC- Dehri, Rohtas	1	0	4/11/2012	5000
	Dengue	Sasaram	1	0	2/11/2012	200
	Dengue	Block- Dehri PHC- Dehri Moh- Indarpuri colony, Dehri On Sone, Rohtas	1	0	1/11/2012	200

iii) DENGUE OUTBREAKS REPORTED IN ROHTAS IN 2013

Ministry of Health & Family Welfare, IDSP, Govt. of India  
STATE HEALTH SOCIETY, BIHAR  
Disease Outbreak Report FROM IDSP ROHTAS, Bihar IN 2013 for Decision Makers

District	Disease/ Syndrome	Area Affected(Block, PHC, Sub-center, Village	No of Cases	No of Deaths	Date of Outbreak	Date of Reporting	Population of Affected Area
ROHTAS	Dengue	Vill- Parsathua, PHC- Kochas, Dist-Rohtas	1	1	17/07/2013	26/07/2013	6000

Photographs of field visit:



**Conclusion:**

Finding confirms the factors leading to the present outbreak and highlights risk factors and control strategies to prevent future outbreak in the region. Community support and participation is also crucial for the prevention of future outbreaks and improving the health and well being of population in the districts.

**Acknowledgement:**

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