ORIGINAL RESEARCH ARTICLE

A Clinico-Epidemiological study of the burden and outcome of Vector Borne Diseases in a Tertiary Care Hospital, Bengaluru

Shobha[1], Amita Mukhopadhyay[2*], Saraswathi S[1]

Affiliation: 1 Assistant Professor, Dept. of Community Medicine, Bangalore Medical College and Research Institute, Bengaluru.2 Associate Professor in Community Medicine, Akash Institute of Medical Sciences and Research Centre, Bengaluru
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***Author for correspondence**: Dr Amita Mukhopadhyay, MD , No.408, Navami Varsha Apts, Uttarahalli-Kengeri Mn Rd Srinivasapura, Bangalore. Pin: 560060. email id: dr.amukho@gmail.com

ABSTRACT

Background: Vector borne diseases (VBDs) represent a substantial burden in many low and lower middle-income countries, including India. India has become hyper endemic for Dengue, and has the largest population in the world at risk of malaria. In view of rising incidence and geographical spread of VBDs, we conducted a study of vector borne disease admissions and outcomes in a major teaching hospital of Bengaluru, with the aim of determining the sociodemographic profile, bed occupancy rates, treatment outcomes. Methods: We analysed case sheets of all patients admitted for suspected vector borne diseases, during the period 1st January to 31st December 2012, in a major tertiary care and teaching hospital located centrally in Bengaluru city. Results: During January-December 2012, 12696 patients were admitted to medicine wards, of whom suspected VBDs numbered 1209, i.e.10% approximately. Majority of patients were males aged 16-25 years, residents of Bengaluru, Tumakuru and Chikkaballapur. Highest number of admissions occurred in August and September, and lowest in May. Dengue was confirmed in 376 patients and malaria in 78, and 3 patients tested positive for Chikungunya. Average bed occupancy was 4 days/patient. Fifty patients died, giving a mortality outcome of 4.14% among VBD cases and proportional VBD mortality of 2.95% out of 1696 total deaths in Medicine wards. Conclusions: In view of rapid expansion of Bengaluru city and urbanization of surrounding areas, with inevitable unplanned construction and ecological modification, we may expect the incidence of vector borne diseases to increase further in future, with resultant heavy burden of morbidity, mortality and increased stress on the health care delivery systems. It is imperative to carry out widespread mosquito control measures and conduct comprehensive grassroots awareness and education campaigns to minimise the incidence of vector borne diseases.

Key Words: Vector-borne Diseases, Dengue, Malaria, Bengaluru, Morbidity and mortality.

INTRODUCTION

Vector borne diseases (VBDs) represent a substantial burden in many low and lower-middle income countries, including India. Globally, VBDs are endemic in more than 100 countries. These diseases affect more than half of the world's population; they are difficult to predict, prevent or control and to add to the complexity, for most VBDs there is no available vaccine.(1) Dengue epidemics have become more severe, spreading to newer areas which were not endemic until a few years ago. The number of dengue cases has increased over the last three to five years, with recurring epidemics. Every 10 years, the average annual number of cases of Dengue Fever/Dengue Haemorrhagic Fever (DF/DHF) cases reported to the World Health Organization (WHO) continues to grow exponentially. With all four serotypes of the virus detected, India has now become hyper endemic for Dengue. The risk factors, which play a key role in the spread and transmission of dengue and chikungunya include demographic and social changes, globalization, irregularities in water supply and solid waste management, and increased consumerism and air travel.(2) India is characterized predominantly by unstable malaria transmission, the seasonal transmission being related to rains. Due to the low and unstable transmission dynamic, most of the population has little or no immunity towards malaria.(3) India has the largest population in the world at risk of malaria, with 85% living in malarious zones. The combination of *Plasmodium Falciparum* and *Plasmodium vivax*, six primary malaria vectors, several ecotypes including urban malaria, and various transmission intensities ranging from unstable to hyper endemic create a challenging epidemiological scenario in India.(4) In India epidemics of Japanese Encephalitis (JE) are reported from many parts of the country, and it is considered a major paediatric problem. Approximately 597,542,000 people in India live in JE-

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endemic regions, and 1,500 to 4,000 cases are reported every year. (5)

In view of such alarming statistics, we conducted a study of vector borne disease admissions and outcomes in a major teaching hospital of Bengaluru, with the aim of determining the sociodemographic profile of such patients, their bed occupancy rates, treatment outcomes, and other relevant indicators. This report is concerned with admissions for suspected vector-borne diseases for the period January to December 2012.

MATERIAL AND METHODS

Study Area: Our study was done in a major tertiary care and teaching hospital located centrally in Bengaluru city. This hospital is a sentinel surveillance centre for diseases covered under the Integrated Disease Surveillance Programme (IDSP). It has 926 beds, with 189 beds meant for the Medicine Department. On average, 1000 outpatients are seen every day, of whom nearly half are medicine cases.

Study period: We analysed case sheets of all patients admitted for suspected vector borne diseases, during the period 1st January to 31st December 2012.

Sample size: There are, on average, 30 admissions daily in the medicine wards. We expected 15% of these admissions to be for vector borne diseases, and thus calculating, we expected to analyse approximately 1600 case sheets for the year 2012. The final sample size was 1209, comprising all case records for patients admitted with suspected vector-borne disease for the period January to December 2012.

Methods: The Study was undertaken after obtaining clearance from the ethics committee of the teaching institute. Case records were analysed for in-patients admitted with suspected vector borne diseases during the study period. We noted the socio-demographic profile and treatment outcome of these patients. We collected investigation data and results from the Microbiology laboratory of the institute.

Inclusion criteria: All probable/confirmed cases fitting into the IDSP criteria of Vector borne diseases.(6)

RESULTS

Sociodemographic and temporal characteristics: The total number of admissions to Medicine wards during the period January-December 2012 was 12696. Total number of patients admitted with possible vector borne disease was 1209, i.e., approximately 10% of total admissions. The cases were distributed as shown in table 1.

Overall, the majority of patients were males in the age group 16-25 years. The frequency of admission decreased with increasing age, and the male to female ratio was higher in the younger age groups. For older patients, admissions were few and the difference between the numbers of male and female patients was not marked.

As seen in table 2, most of the patients were from Bengaluru (urban as well as rural) district, followed by neighbouring districts of Tumakuru and Chikkaballapur. Also, 44 patients (3.64%) were from neighbouring states

namely, Andhra Pradesh and Tamil Nadu. The majority of patients belonged to the Hindu religion, with Muslims accounting for about 14% of the total.

Distinct differences in the number of admissions were observed over the 12-month period as shown in figure 1. The months of August and September witnessed the highest number of admissions, followed by a steady decline till December. In the initial months of the year, admissions were relatively fewer with the fewest cases in May (11 cases; 5 males).

Table 1: Age and sex distribution of patients

Age group in years	Male		Female		Total
	n	%	n	%	
16-25	296	62.44	178	37.55	474
26-35	218	67.28	106	32.71	324
36-45	108	58.06	78	41.93	186
46-55	56	48.69	59	51.3	115
56-65	39	46.42	45	53.57	84
66-75	14	58.33	10	41.66	24
76-85	2	100	0	0	2
Total	733	60.63	476	39.37	1209

$X2=21.15, p<0.01$

Table 2: Distribution by district and religion

District	n	%
Bengaluru	496	41.03
Tumakuru	283	23.41
Chikkaballapur	119	9.84
Ramanagara	76	6.29
Kolar	50	4.13
Others	141	11.66
Andhra Pradesh	38	3.14
Tamil Nadu	6	0.49
Religion	n	%
Hindu	1029	85.11
Muslim	168	13.89
Christian	9	0.74
Other	3	0.25
Total	1209	100

VBD cases compared to total admissions: The admission rate to medicine wards over the 12-month period remained fairly constant. However, the contribution of VBD cases fluctuated as shown in table 3 and figure 2. The proportion of patients admitted with suspected VBD ranged from a minimum of less than 1% in the month of May, to a maximum approaching 20% during August and September. The average proportion of VBD patients among total admissions during the year was 9.27%.

Duration of admission: Patients' duration of stay in the hospital ranged from some hours to 24 days, median duration of stay being 4 days. The total number of bed-days was 4883, giving average bed occupancy of 4 days per patient.

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Table 3: Monthly VBD cases as percentage of total admissions

Month (2012)	Total medicine ward admissions	Suspected VBD admissions	VBD as percentage of total admissions
January	895	38	4.24
February	904	48	5.3
March	951	26	2.73
April	1071	35	3.26
May	1142	11	0.96
June	1096	125	11.4
July	1104	154	13.94
August	1103	202	18.31
September	1169	207	17.7
October	1115	171	15.33
November	1050	118	11.23
December	1096	74	6.75

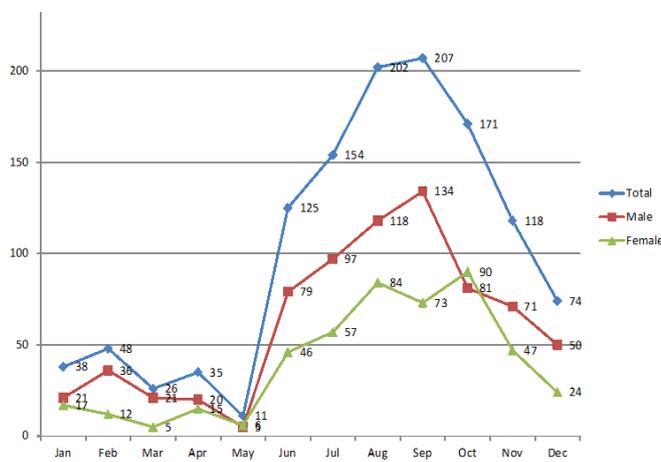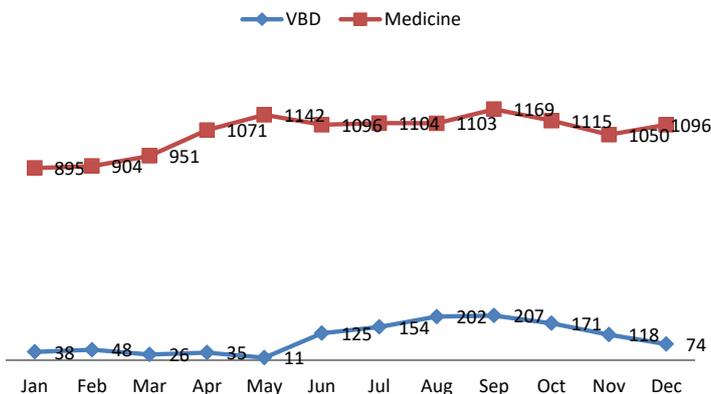**Fig. 1: Temporal distribution of cases**

Fig. 2: VBD cases compared to total medicine ward admissions

Provisional and confirmed diagnoses: Most of the cases were admitted as fever with thrombocytopenia, out of which 232 cases tested positive for dengue. 110 cases had a provisional diagnosis of Dengue, of which 63 were confirmed as dengue. 42 of the 187 acute fever cases tested positive for dengue. Overall, 376 patients may be considered as dengue cases based on positive test reports. Of the 35 patients admitted provisionally as Malaria, 11 were confirmed as malaria.

Investigations: Peripheral smears were done for 796 patients, of which 78 were positive. Of these, species identification report available for 73 cases showed that 26 were Plasmodium falciparum, 43 were vivax and 4 smears had both parasite species.

According to the case records, 5 patients were tested for Chikungunya and 3 tested positive.

Treatment:

Malaria: It was observed that 24 cases were given Injectable artemisinin. Oral artemisinin was given to 15 cases.

Dengue: 239 patients were given platelet transfusion. It was also observed that among those who did not receive platelet transfusion, 9 patients did have counts below 20000 per cubic mm.

Treatment outcome: Out of 1209 patients admitted for possible vector borne disease, 979 (80.98%) were classified as improved/cured at discharge, 50 patients (4.14%) died and 171 (14.14%) were discharged against medical advice. The remaining 9 patients were referred elsewhere or absconded. Mortality from suspected vector-borne disease constituted 2.95% of total deaths in Medicine wards (1696), which points towards mostly good outcome for these patients.

DISCUSSION

In this study of patients admitted for suspected vector borne disease, it was observed that the majority of admissions were young adults, with male patients significantly outnumbering female patients, especially in the younger age groups. In the present study, male patients constituted 60.63% and female patients, 39.37% of total admissions. This may be explained by the higher outdoor activity among younger age groups and males, which makes them more exposed to mosquito bites, along with the general clothing norms due to which more body surface area is exposed in males. A similar retrospective study of dengue fever from a teaching institute in Kerala state also reported preponderance of males and young adults, with males accounting for 60.70% and females, 39.29% of total dengue fever cases.(7)

In the present study, most of the admissions were from Bengaluru and surrounding districts, and religion of the patients conformed to the general demography of the population of Karnataka with Hindus in majority followed by Muslims and others.(8)

Majority of the patients presented with symptoms suggestive of dengue. Confirmed diagnosis of dengue was made in 376 patients, and malaria in 78. The highest number of admissions was seen during the monsoon months July to October. This corresponds to known seasonal fluctuations in the incidence pattern of VBDs, with factors like temperature, rainfall and humidity playing a role.

In their 2015 study on Aedes aegypti vector prevalence, Balakrishnan et al(9) obtained data on the incidence of

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dengue and chikungunya for the period 2008-2012, from Karnataka state health authorities. Although the data showed dengue and chikungunya to be prevalent in many of the districts, Bengaluru City and its neighbouring districts accounted for a large number of cases, with Bengaluru city accounting for 28.8% of dengue cases during the reporting period. The authors also reported the results of entomological surveillance on the prevalence of Aedes aegypti carried out by the NCDC (National Centre for Disease Control) team during 2012 in selected localities of Bengaluru City, Bengaluru urban and Kolar districts of Karnataka state. The results of the study revealed widespread vector mosquito breeding and the Aedes larval breeding indices — House, Container and Breteau — for total study area were 23.9, 11.6 and 43.0 respectively. Of the 10 localities surveyed, 9 showed House and Breteau indices above the critical levels. Another study of vector borne diseases conducted by Nazrul Islam et al in Bengaluru(10) reported 51 samples positive for larvae out of 224 larval samples collected, of which 37 were positive for Aedes (27 A. aegypti), 12 for Anopheles, and two were positive for Culex. Such widespread breeding of Aedes aegypti may be the cause of the preponderance of dengue cases observed in the present study.

The mortality among the VBD patients in the present study was found to be 4.14% (2.95% proportional mortality with respect to total medicine ward deaths). This is similar to the 3.2% mortality reported from a 2005 study of dengue in Kollam, Kerala.(11)

Conclusion and recommendations: Vector-borne diseases are both age-old and re-emerging situations, with previously unheard-of complications, changing geographical and epidemiological patterns and the ever-present spectre of drug resistance. In view of rapid and constant expansion of Bengaluru city and urbanization of surrounding areas, with inevitable unplanned construction, water stagnation and ecological modification, we may expect the incidence of vector borne diseases to increase further in future, with resultant heavy burden of morbidity, mortality and increased stress on the health care delivery systems. It is imperative to carry out mosquito control measures on a war footing especially during the monsoon season. It is also highly advisable to conduct widespread grassroots awareness campaigns in order to educate the general population about the modes of spread of vector mosquitoes and preventive and protective measures that can be undertaken at the individual and community levels to minimise the incidence of vector borne diseases.

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