Original Article

Paradigm Shift in Socio-Demographic Profile of Dengue Infection: A Hospital Based Cross-Sectional Study

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Abstract

Background: Dengue is the most rapidly spreading mosquito borne viral disease in the world with increasing geographical expansion to new countries and from urban to rural settings due to combination of urbanisation, population growth, increased international travel and trade and global warming. The epidemiology of dengue fever in India has been very complex with a seasonal pattern. The first outbreak in Odisha was in 2010 and is now spreading to different districts of the state. **Materials and Methods:** A hospital based cross-sectional study was carried out between 2017 to 2018 in the dengue ward of a teaching hospital in Berhampur, Ganjam district of Odisha. **Results:** The prevalence of admitted dengue patients was 4.32%. Majority of the patients were males (81.9%) and ≥15 years old (91.7%). About 68.5% were from rural areas and belonged to low socio-economic status (53.2%). Cases were reported mostly in peri-monsoon periods and 65.7% of them came directly to the hospital. **Conclusion:** The study highlights the need to curb the rural spread of the disease through activities in creating awareness among all section of people to promote control measures and early reporting of all fever cases, capacity building of rural doctors for early detection, treatment and early referral of high-risk patients and availability of ELISA based tests in sub-district hospitals along with Rapid Diagnostic Kits (RDKs). Emphasis for preventive and control measures to be increased during peri-monsoon periods and also to be instituted in offices, educational institutes and other indoor activity areas.

Keywords: Dengue fever, outbreak, socio-demographic variables

Introduction

Dengue is a rapidly spreading mosquito-borne viral disease in the world. Though it was most prevalent in tropical and sub-tropical countries but in recent years the incidence of dengue worldwide has increased dramatically with increasing geographical expansion to new countries and from urban to rural settings which might be due to combination of urbanisation, population growth, increased international travel and trade and global warming. Currently, it is an endemic in more than 100 countries.[1-3] As per the World Health Organization (WHO) estimates, about 2/5th of world population is at risk of this viral disease and globally, the estimated number of disability-adjusted life years (DALYs) per million population per year lost due to dengue is 264. It infects 50 to 100 million people worldwide per year leading to 0.5 million hospitalisations and 20 thousand deaths annually.[2-5]

The epidemiology of dengue fever in India has substantially changed over almost past 60 years in terms of severity and prevalent strains.[6] It is not uniformly distributed throughout the year and has a seasonal pattern *i.e.* the cases peak after monsoon.[5]

Odisha is a state in eastern part of India and reported the first dengue outbreak in 2010 followed by extensive outbreaks in 2011 and 2013.[7,8] The mosquito-borne disease is spreading to different districts of the state between the months of July to December.[9]

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This hospital-based study aims to find the prevalence of admitted dengue cases, the socio-demographic divide of dengue fever and the factors influencing in seeking care in a teaching hospital.

Materials and Methods

Maharaja Krusha Chandra Gajapati (MKCG) Medical College and Hospital is one of the apex institutes in Odisha situated in Berhampur catering to the health needs of southern and its adjoining districts of Odisha and some regions of Andhra Pradesh. A hospital based cross-sectional study was carried out in the dengue ward of medicine and paediatrics in between January 2017 to October 2018. All admitted dengue cases were included as the study population after taking their informed consent.

Inclusion criteria consisted of a case compatible with clinical description (clinical criteria) and serologically, non-ELISA based NS1 antigen/IgM positive cases or ELISA- NS1 antigen and IgM (single serum) positive cases as mentioned in the National Guidelines for Clinical Management of Dengue Fever, 2014.[2] The blood samples were tested by ELISA methods in the Microbiology Department of MKCG Medical College and Hospital or by rapid immune-chromatographic test (ICT) or Dengue Day 1 kit (manufactured by J. Mitra and Co. Pvt. Ltd) in a private laboratory.

Patients with incomplete data were excluded. A predesigned, pretested and validated questionnaire was used for data extraction.

Statistical analysis

Descriptive statistics were applied and reported proportion was with 95% CI wherever applicable using SPSS Version 21.0.0.

Ethical approval

The study was conducted after obtaining due approval from the Institute Ethics Committee, MKCG Medical College and Hospital and written informed consent was taken from all study participants.

Results

A total of 216 dengue cases were taken as study population. The prevalence of admitted Dengue patients in the in-patient department of medicine and paediatrics ward of MKCG Medical College and Hospital was found to be 4.32% (3.79-4.92%).

The age-distribution of the study population is described in Table 1. Majority of the patients (91.7%) were ≥15 years old and 81.9% were male. Highest number of patients (23.6%) belonged to 26-30 years age-group. Only 7.4% of dengue cases were more than 50 years of age. Mostly paediatric cases were between 6-10 years old which constitute 6.4% of total cases.

As depicted in Table 2, majority (94.4%) of the patients were Hindu by religion. More than half (68.5%) of the cases were from rural areas and belonged to low socio-economic status (53.2%). Around 30% of cases had secondary education and very few were illiterate (5.5%). The socio-economic status of the head of the family was assessed using the WHO scale because the study cases were a blend of both urban and rural population.

Table 1: Age and sex distribution of dengue cases (*n*=216)

Age Group (years)	Male (%)	Female (%)	Total (%)
1-5	1 (0.4)	1 (0.4)	2 (0.9)
6-10	10 (4.6)	4 (1.8)	14 (6.4)
11-15	2 (0.9)	0 (0.0)	2 (0.9)
16-20	30 (13.8)	1 (0.4)	31 (14.3)
21-25	24 (11.1)	8 (3.7)	32 (14.8)
26-30	41 (18.9)	10 (4.6)	51 (23.6)
31-35	34 (15.7)	4 (1.8)	38 (17.5)
36-40	10 (4.6)	1 (0.4)	11 (5.0)
41-45	5 (2.3)	2 (0.9)	7 (3.2)
46-50	8 (3.7)	4 (1.8)	12 (5.5)
>50	12 (5.5)	4 (1.8)	16 (7.4)

Table 2: Socio-demographic characteristics of dengue cases (*n*=216)

Characteristics	*n* (%)
Religion	
Hindu	204 (94.4)
Muslim	5 (2.3)
Christians	7 (3.2)
Residence	
Urban	68 (31.4)
Rural	148 (68.5)
Education	
Illiterate	12 (5.5)
Primary	61 (28.2)
Secondary	66 (30.5)
Higher secondary	34 (15.7)
Graduate and above	39 (18.0)
Socio-economic status	
Upper	30 (13.8)
Middle	71 (32.8)
Lower	115 (53.2)

District-wise distribution of dengue cases [Figure 1] showed that 73.1% of the patients were from the district of Ganjam followed by adjoining districts. The seasonal trend of dengue as depicted in Figure 2 clearly showed that cases were reported mostly between June to December in monsoon and post monsoon periods.

Out of 216 dengue cases, more dengue cases (65.7%) came directly to the hospital than referred from other health facilities (34.2%). No significant association was found between residence and type of admission [Table 3].

Figure 3 depicts that 34.2% of the cases had undergone treatment before being admitted to the tertiary care hospital, majority being referred from other govt. hospitals (43.0%). The referred cases had received medications to alleviate symptoms. Few of them had received IV-fluid, anti-malaria drugs, antibiotic and pain killers as treatment.

Table 3: Type of admission to different wards of the hospital

Type of admission	Medicine ward			Paediatrics ward			Total dengue cases (*n*=216)
	Urban (*n*=62)	Rural (*n*=136)	Total (*n*=198)	Urban (*n*=06)	Rural (*n*=12)	Total (*n*=18)	
Direct	41 (66.1)	89 (65.4)	130 (65.6)	04 (66.6)	08 (66.6)	12 (66.6)	142 (65.7)
Referred	21 (33.8)	47 (34.5)	68 (34.3)	02 (33.3)	04 (33.3)	06 (33.3)	74 (34.2)

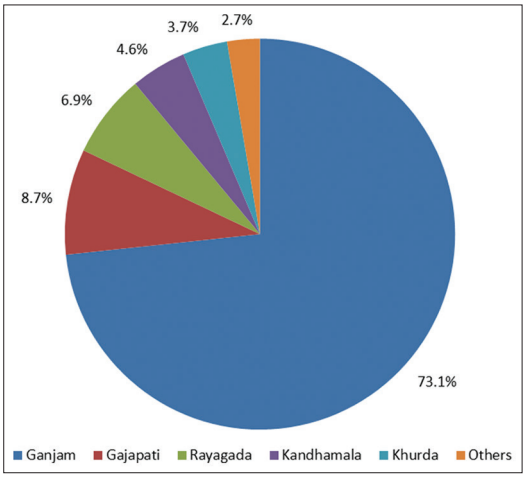

Figure 1: District-wise Distribution of cases (*n* = 216)

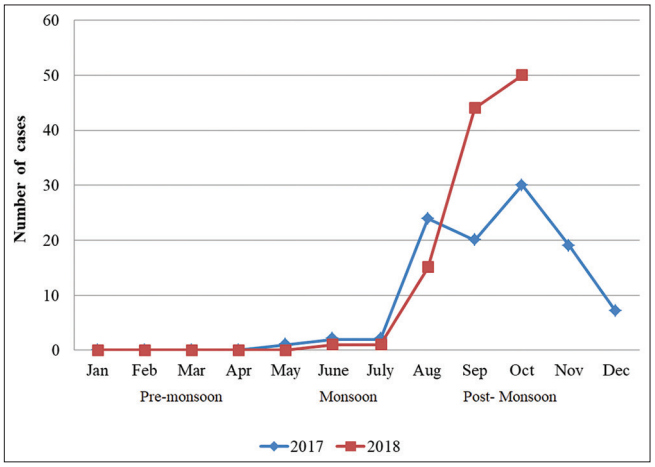

Figure 2: Seasonal trend of dengue 2017 - 2018

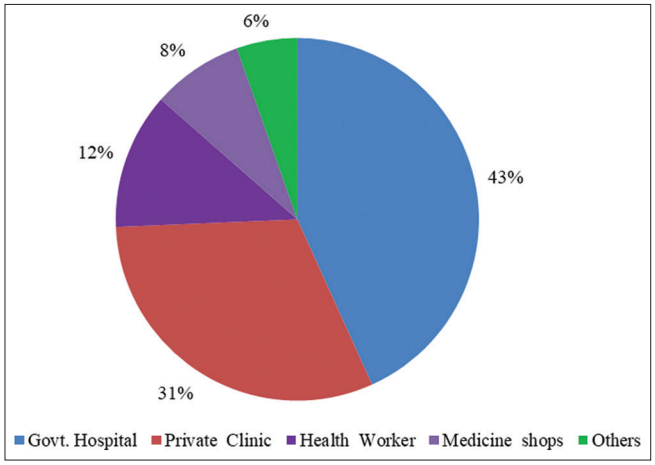

Figure 3: Source / Site of Pre-referral Treatment (*n*=74)

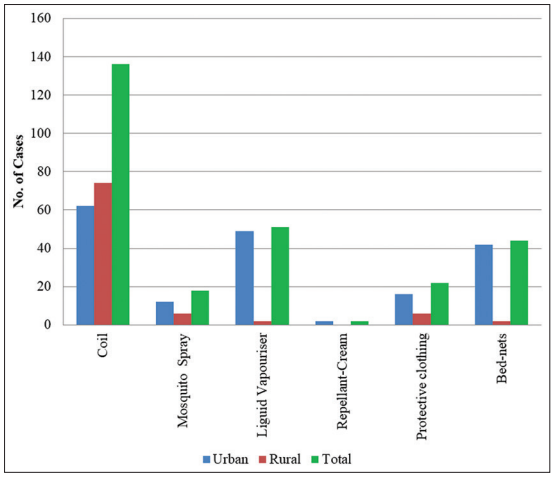

Figure 4: Personal protection measures adopted at home (*n*=216)

About 74% of patients were admitted within four days of onset of symptoms. Very few (7.4%) were admitted after 7 days as shown in Table 4.

As shown in Figure 4, 62.9% of the families both in urban and rural areas used coils followed by liquid vaporiser (23.6%) and bed nets (20.3%). But liquid vaporisers and bed nets were used mostly by urban dwellers. As stated by the respondents, all these measures were mostly adopted at nights.

Discussion

This hospital-based cross-sectional study was conducted among 216 dengue patients consisting of 177 males, 39 females and 18 children in a tertiary care hospital.

Socio-demographic characteristics of dengue cases

This study highlights young age group's (26-35 years) vulnerability in acquiring dengue infection and the male: female ratio was found to be 4.5:1. The Aedes mosquito lives and breeds indoors, has a limited flight range, and feeds almost exclusively on humans.[2,5] Exposure of males and younger age groups to Aedes mosquito bites at work/study place and covered clothing practices of women and children might be the reason of their protection. Importance of males in the society which influences their health seeking behaviour might have added to it as reported by similar findings by Kauser *et al.*, and Kumar *et al.*,[10,11] However vulnerability of children and females cannot be ruled out as observed in studies by Gunasekaran *et al.*, in Chennai and Sarkar *et al.*, in West Bengal, indicating persons who spend more time at home during daytime (mothers and

Table 4: Time lag between appearance of symptoms and admission to different wards of the hospital

Time lag	Medicine ward			Paediatrics ward			Total dengue cases (*n*=216)
	Urban (*n*=62)	Rural (*n*=136)	Total (*n*=198)	Urban (*n*=06)	Rural (*n*=12)	Total (*n*=18)	
≤4 days	51 (82.2)	100 (73.5)	151 (76.2)	5 (83.3)	4 (33.3)	9 (50.0)	160 (74.0)
5-7 days	8 (12.9)	25 (18.3)	33 (16.6)	1 (5.5)	6 (50.0)	7 (38.8)	40 (18.5)
>7 days	3 (4.8)	11 (8.0)	14 (7.0)	0 (0.0)	2 (16.6)	2 (11.1)	16 (7.4)

children) are also likely to be infected than those who leave home for work.[12,13]

Dengue has traditionally been held to be a disease of high population density tropical urban areas as found in various studies.[14,15] However it is rapidly spreading to rural areas as also found in this study. The cut bamboo stumps, tree holes, plant leaf axils, discarded coconut shells and glass bottles are the natural habitats that store rain water facilitating breeding of potential dengue vectors in and around the rural dwellings.[16] Proximity to animal sheds, improvement in water supply but poorly managed water storage and drainage system due to lack of awareness in rural areas might also be the cause behind the rural spread of this disease. This has also been suggested by some review articles by Guha *et al.*, that role of socio-economic and cultural factors indicating towards certain traditional and behavioural practices along with individual susceptibility that lead to occurrence of dengue.[17,18] Increasing reports of dengue cases from rural areas has been documented over the years.[19-21] Nevertheless, during an outbreak of dengue in Tamil Nadu (2005), evidence for the circulation of more than one serotype of DENV in both rural and urban areas were found by Paramasivan *et al.*[22]

Seasonal trend of dengue outbreaks

Month-wise distribution of dengue cases in the current study clearly shows the seasonal trend of this disease as stagnant water after rainfall favouring the breeding of mosquitoes, favourable temperature and relative humidity affecting their life span are responsible for increase in incidence of dengue during post-monsoon period as has also been previously reported.[23-26]

Importance of early reporting during dengue outbreaks

No significant association was found between residence and type of admission (direct or referred) as better cost-effective health services, good diagnostic facilities in a tertiary care centre as well as lack of adequate health centres, proper infrastructure and shortage of doctors in rural areas might be the reasons for patients coming directly to this hospital.

Critical phase in dengue occurs after 3-4 days of onset of fever marked by warning signs which is important for early diagnosis and treatment to prevent complications and death in dengue. In the current study early reporting (≤4 days) to hospital was more among urban patients which was more pronounced among paediatric age groups ($P < 0.05$). The delay among rural patients could be due to cultural factors, lack of awareness or distance from the tertiary care centre. Wu H *et al.*, suggested that large proportion of inapparent infections in dengue plays an important role in transmitting the disease during epidemics. Hence timely diagnosis and case reporting along with early, continuous and high efficacy vector control interventions are necessary to limit the development of a dengue epidemic.[27]

Importance of travel in the spread of dengue infection

Though in this study it was also observed that most of the cases were from the same district and very few were from nearby districts but travel to endemic areas of malaria and dengue should be considered while dealing with any undifferentiated viral fever cases during peri-monsoon period.[1-3] Swain S *et al.*, in a case control study suggested that along with social and ecological factors, travel/commuting are also essential factors to be considered during disease prevention planning.[28]

Role of vector control and mosquito protection measure in curbing dengue infection in the society

Krishnamoorthy Y *et al.*, in a household survey on public awareness and attitudes toward dengue infection stressed on motivation, especially of the rural population needs to be done at frequent intervals in bringing about the behavioural change for usage of personal prophylactic measures for mosquito control.[29] All the mosquito protection measures as observed in the current study were adopted at nights which cannot stop the spread of dengue infection. Bed nets as such has less protective role in control of dengue but it can give some protection to infants and those who take afternoon nap and who work at nights and sleep during daytime.

Though numerous steps has been taken by the Govt. of India to create awareness on dengue like observation of 16th May as National Dengue Day and July as Anti-Dengue Month, establishment of a National Health Portal, in six different languages, for dissemination of authentic health-related information, launching of a mobile application, 'India Fights Dengue,' to carry out the behaviour change communication campaigns and mass clean-up campaigns linked with the 'Swachh Bharat Abhiyan' (Clean India Mission).[30] Hence protective measures not only at homes but also in educational-training institutes and offices should be instituted.

Limitation of the study

The study included only admitted dengue cases in a tertiary care hospital and therefore could have missed outdoor patients who

presented just with un-differentiated fever or milder form of dengue infection.

Relevance of this study with respect to primary care physician

Dengue is no more confined to high density urban areas of tropical and subtropical regions. Worldwide a paradigm shift has been observed in the epidemiology of dengue outbreak due to urbanisation, population growth, international travel and global warming. It is a viral disease most commonly encountered in primary care setting in which early diagnosis and treatment is as important as preventive measures undertaken.

Hence, importance in the role of primary care physicians, rural doctors or physicians posted in peripheral health institutions cannot be ignored to curb future outbreaks. As lack of competency in case management, especially at the primary and secondary healthcare levels, has already been identified by the Joint Monitoring Mission (JMM) on vector-borne diseases.[31] Mohammed Yusuf A *et al.*, in his study found that the odds of healthcare professionals who took dengue fever prevention training were 10.23 times higher than the odds for health-care professionals who had not received the training on level of practice for dengue prevention.[32] Nguyen *et al.*, in a KAP survey focussed on greater role for primary care physicians in dengue control and not just in clinical management and mortality reduction. It identified missed opportunities to prevent dengue transmission around households by incorporation of better communication strategies.[33]

Additionally, there is a bidirectional association between risk perception and behaviour in disease transmission with respect to vector borne diseases as shown by Aerts C *et al.*,[34] Also there is a necessity to have ELISA based tests in district hospitals and peripheral health centres along with Rapid Diagnostic Kits (RDKs) for early detection, treatment and early referral of high-risk patients. Hence capacity building of rural doctors as per recent national guidelines for immediate diagnosis and appropriate management is required along with activities in creating awareness among all section of people to promote control measures and early reporting of all fever cases to nearby health centres.

Conclusion

This study clearly points towards a shift in the epidemiology of dengue infection among admitted dengue cases in a teaching hospital in eastern India. The rural spread of the disease highlights the natural habitats and poor water management facilitating the breeding of mosquitoes. Though disease distribution showed adult and male preponderance, vulnerability of women, children and elderly cannot be ruled out. The findings in this study emphasises that preventive and control measures should be increased during peri-monsoon periods and should also be instituted in offices, educational institutes and other indoor activity areas. Public awareness campaigns need to be enhanced to improve usage of personal protective measures as well as to overcome the variation in reporting pattern between urban and rural dwellers. Lastly capacity building of primary care physicians and rural doctors needs to be focused to curb future outbreaks.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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