

Dengue Prevalence and its Predictors Among the Suspected Cases Attending at Puthia Health Complex, Rajshahi

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Abstract

Background: Dengue is an important arthropod-borne viral infection which poses a global public health problem. The burden of dengue cases reached its worst not only in major cities but also in all the districts of Bangladesh. **Objectives:** To estimate the prevalence of dengue fever and identify its important correlates and predictors in rural Bangladesh. **Methods:** This was a cross-sectional descriptive study conducted at Puthia Upazilla Health Complex (UHC), Rajshahi, Bangladesh. The suspected cases of dengue fever attending at the Health Complex constituted the study population. A total of 328 suspected cases were included in this study. NS1 Ag (1-5 days of fever) or IgM test (after 5 days of fever) were performed for the confirming the diagnosis of the suspected cases in the pathological laboratory of the UHC. Data were collected by data collection sheet from the Laboratory Register Book and through telephonic interview. Chi-square and t test were applied to find out the association between the status of dengue fever, and the socio-demographic and symptomatic characteristics. Multiple logistic regression was applied to identify the socio-demographic and symptomatic predictors of dengue fever. **Results:** Prevalence of dengue fever in suspected cases was 5.2%. The mean age of the dengue positive cases (38.08 ± 17.50) was significantly higher than dengue negative cases (23.46 ± 15.16) ($P=0.002$) and the majority (83.30%) of the positive cases were male. There were no significant ($P>0.05$) differentiation of dengue fever status, i.e. dengue fever positive or negative, in regard of gender, educational qualification, monthly family income, number of household members and history of recent visits to Dhaka. Common clinical features of dengue fever except myalgia and arthralgia were not statistically associated with the dengue fever. None of the clinical features were identified as an independent predictor of dengue fever. **Conclusion:** The present study noticed two important epidemiological shifting of dengue fever. First one, dengue fever also prevalent in rural area. This is a warning message to the health authority of Bangladesh, because generally dengue is an urban disease. Second one, dengue is experiencing a demographic shift to older ages. As a result it is increasing the disease burden to the adult population as well as its clinical management of the subgroup becomes very challenging.

Key words: Dengue fever, Prevalence, Correlates, Predictors, Bangladesh

Introduction

Dengue has emerged as a significant public health issue in Asia since 1950.¹ The incidence of dengue has experienced a significant surge on a global scale in recent decades, as evidenced by the notable increase in cases reported to the World Health Organization (WHO). In the year 2000, the number of reported cases was 505,430, whereas in 2019, this figure escalated to a staggering 5.2 million.² In Bangladesh, both the number of reported cases and death increased drastically in 2023. In this year, the burden of dengue cases reached its worst not only in major cities but also in most districts of Bangladesh. In 2022, the number of reported dengue cases in Bangladesh was 62382 and the number of reported death was 281.³ While, by 12th October 2023 the number of reported cases reached to 231204 and the number of reported death was 1122.⁴ However, it is worth noting that the actual number of cases and deaths may be higher than reported by the state.

Dengue viral disease is caused by an arbovirus transmitted by mosquitoes of the genus *Aedes*. There are four serotypes of the dengue virus, namely DENV-1, DENV-2, DENV-3, and DENV-4.⁵ The disease manifestations encompasses a spectrum of conditions like influenza like dengue fever, dengue hemorrhagic fever and dengue shock syndrome.⁶

The clinical features of dengue includes fever, arthralgia, myalgia, retroorbital pain, rash, subconjunctival hemorrhages, hemorrhage from other different sites, respiratory symptoms, gastrointestinal problems and other symptoms.⁷ Atypical presentation like hepatitis, febrile diarrhoea, bradycardia, meningitis, encephalitis were also reported by several studies.^{8,9} Asymptomatic infection also encompasses a significant percentage of

the total cases. According to a meta-analysis the pooled prevalence of asymptomatic dengue infection was 59.26% and this may play significant role in disease transmission.¹⁰ The clinical diagnosis of dengue can pose a considerable challenge due to the similarity of symptoms with various other illnesses like viral flu, influenza, Chikungunya, measles, gastroenteritis etc. Although dengue is consider as an urban disease but increase incidence rate in rural areas is reported all over the country may be due to travels, urbanization etc.¹¹ Keeping all them in mind this study designed to estimate the prevalence of dengue fever and identify the important correlates and predictors of dengue fever in rural Bangladesh.

Methods

This was a cross-sectional descriptive study conducted at Puthia Upazilla Health Complex (UHC), Rajshahi, Bangladesh with a view to find out longitudinal prevalence of dengue fever, and its correlates and predictors. The suspected cases of dengue fever attending at the Health Complex constituted the study population. A total of 328 suspected cases of dengue fever (acute febrile illness with or without non-specific signs and symptoms.) referred to pathological laboratory of the UHC from February 2023 to August 2023 were selected for the study as sample. NS1 Ag (1-5 days of fever) or IgM test test (after 5 days of fever) were performed for the confirming the diagnosis of the referred suspected cases. The referred patient's name with address, telephone number, age, gender and result of NS1 Ag or IgM test were recorded in a Laboratory Register Book (LRB). NS1Ag or IgM antibody test status was considered as gold standard for the diagnosis of dengue fever.

All 3rd year medical students of Barind Medical College of 2020-21 session collected the data with a help of a data collection sheet from the LRB and through telephonic interview. The data collection sheet was designed to record the name and address, mobile number, NS1Ag and IgM antibody test results, socio-demographic status of the patients and their complains/symptoms during seeking their treatment. Data regarding NS1Ag and IgM antibody test status, age and gender of the suspected patients were collected from LRB. The rest of the socio-demographic data of the patients and their complains/symptoms were collected through telephonic interview. A written permission from UH & FPO of the health complex was taken before data collection from LRB. A verbal consent was also taken from the patient with assurance to maintain confidentiality and privacy at the beginning of the telephonic interview.

Data were analyzed in the computer using SPSS for windows. Descriptive analytical techniques involving frequency distribution, computation of percentage etc. were applied. Chi-square and t test were applied to find out the association between the status of dengue fever, and the socio-demographic and symptomatic characteristics. Multiple logistic regression was applied to identify the socio-demographic and symptomatic predictors of dengue fever.

Results

This single centered cross sectional descriptive study was conducted in Puthia Upazilla Health Complex, Rajshahi. A total of 328 suspected dengue cases were found in the LRB of the health complex from the time period of February 2023 to August 2023. The mean age of the suspected dengue cases was 29.43 ± 15.31 years and the majority of them

were male (61.6%) (Table I).

A total of 328 suspected cases, 307 (93.6%) cases were referred for NS1 antigen and the rest 21 (6.4%) cases were referred for IgM antibody test. Out of 307 referred cases for NS1 antigen test, 16 (5.2%) were positive. Among 21 referred cases for IgM antibody test, 1 (4.8%) was positive. Of these 328 suspected dengue cases, 17 (5.2%) were positive and the rest 311 (94.8%) cases were negative for dengue fever. However, the overall prevalence of dengue fever in suspected cases was 5.2% (Table II).

Out of these 328 cases, it was possible to contact 159 cases over the phone for the supplementary data regarding socio-demographic status except age and sex which were recorded in LRB, and symptomatic characteristics of the cases. Among these 159 cases, 11 were positive for Dengue Ns1 Antigen and 01 was positive for Dengue IgM antibody. The mean age of the dengue positive cases (38.08 ± 17.50) was significantly higher than dengue negative cases (23.46 ± 15.16) ($P=0.002$) and the majority (83.30%) of the positive cases were male. About 58.30% dengue-positive cases have educational qualifications up to primary, and 61.50% have monthly family income <20000 BDT. About 58.30% dengue-positive cases had >4 household member and 16.70% had a history of recent visits in Dhaka. There were no significant ($P>0.05$) differentiation of dengue fever status, i.e. dengue fever positive or negative, in regard of gender, educational qualification, monthly family income, number of household members and history of recent visits to Dhaka (Table III).

Symptoms like headache, myalgia, arthralgia/bone pain, retro-orbital pain, skin rash and bleeding were found in

59.70%, 30.80%, 23.30%, 13.80%, 18.90% and 8.20% dengue suspected cases respectively. Among these, myalgia and arthralgia were statistically significantly higher in dengue-positive cases than in negative cases ($P=0.038$ and 0.033 respectively). The others clinical features were not statistically associated with dengue fever (Table IV). In logistic regression analysis, none of the clinical features independently associated with dengue fever status (Table V).

Table I. Demographic profile of suspected patients of dengue fever attending at Puthia UHC (n=328).

Variable	Fequency (N)	Percentage (%)
Agegroup (years)		
≤20	112	34.1
21 – 40	132	40.2
41 -60	77	23.5
>60	7	2.1
Mean Age (years)		
Mean±SD	29.43±15.31	
Gender		
Male	202	61.6
Female	126	38.4

Table II: Prevalence of dengue fever in suspected cases (n = 328).

Referred for the test	Test status	Frequency (percentage) N (%)
Dengue NS1 antigen n = 307	Positive	16 (5.2)
	Negative	291(94.8)
Dengue IgM antibody n = 21	Positive	1 (4.8)
	Negative	20 (95.2)
Either NS1 antigen or IgM antibody (Overall) n = 328	Positive	17 (5.2)
	Negative	311 (94.8)

Table III. Association between dengue fever status of the patients and their socio-demographic characteristics (n=159).

Variable	Positive (n=12)	Negative (n=147)	Total (n=159)	P value
Age in years				
Mean±SD	38.08±17.50	23.46±15.16	24.57±15.77	0.002 ^a
Age group (years)				
≤20years	3 (25.0)	73 (49.7)	76 (47.8)	
21 – 40 years	3 (25.0)	58 (39.5)	61 (38.4)	
>40 years	6 (50.0)	16 (10.9)	22 (13.8)	<0.001 ^b
Gender				
Male	10 (83.3)	89 (60.5)	99 (62.3)	0.101 ^b
Female	02 (16.7)	58 (39.5)	60 (37.7)	
Education				
Up to primary	7 (58.3)	76 (51.7)	83 (52.2)	
Secondary and higher secondary	4 (33.3)	54 (36.7)	58 (36.5)	0.891 ^b
Graduation and above	1 (8.3)	17 (11.6)	18 (11.3)	
Monthly family income (BDT)				
<20000	7 (61.5)	98 (66.7)	105 (66.0)	
20001-40000	5 (41.7)	46 (31.3)	51 (32.1)	0.693 ^b
>40000	0 (0.0)	03 (2.0)	01 (0.6)	
Household member				
≤04	5 (41.7)	76 (51.7)	81 (50.9)	
>04	7 (58.3)	71 (43.3)	78 (49.1)	0.357 ^b
History of Peccent Visit to Dhaka				
Yes	2 (16.7)	25 (17.0)	27 (17.0)	
No	10 (83.3)	122 (83.0)	152 (83.0)	0.668 ^b

^aUnpaired t-test was performed to compare the mean between the groups and ^bChi-squared Test (X^2) was performed to compare frequency between the groups.

Table IV. Symptoms found among the patients who were confirmed over phone (n=159)

Variable	Positive (n=13)	Negative (n=146)	Total (n=159)	P value
Headache				
Yes	10 (83.3)	85 (57.8)	95 (59.7)	0.073 ^b
No	2 (16.7)	62 (42.2)	64 (40.3)	
Myalgia				
Yes	7 (58.3)	42 (28.6)	49 (30.8)	0.038 ^b
No	5 (41.7)	105 (71.4)	64 (40.3)	
Arthralgia/Bone pain				
Yes	6 (50.0)	31 (21.1)	37 (23.3)	0.033 ^b
No	6 (50.0)	116 (78.9)	64 (76.7)	
Retro-orbital pain				
Yes	1 (8.3)	21 (14.3)	22 (13.8)	0.483 ^b
No	11 (91.7)	126 (85.7)	137 (86.2)	
Skin rash				
Yes	3 (25.0)	27 (18.4)	30 (18.9)	0.402 ^b
No	9 (75.0)	120 (81.6)	129 (81.1)	
Bleeding				
Yes	2 (16.7)	11 (7.5)	13 (8.2)	0.255 ^b
No	10 (83.3)	136 (92.5)	146 (91.8)	

^bChi-squared Test (χ^2) was performed to compare frequency between the groups.

Table V. Multiple Logistic regression analysis of dengue fever predictors. (n=159).

Variables	Odds ratio	95% CI	p-value
Headache	0.390	0.068 – 2.253	0.293
Myalgia	0.722	0.160 – 3.266	0.672
Arthralgia/ Bone pain	0.309	0.073 – 1.310	0.111
Retro-orbital pain	7.335	0.447 – 120.259	0.163
Skin rash	1.00	0.179 – 5.598	1.00
Bleeding	0.230	0.020 – 2.622	0.236

Discussion

After malaria, Dengue is the second most prevalent mosquito-transmitted disease affecting human beings and about half of the population of this world being at risk of dengue.¹² It is a vector borne infectious disease caused by single-stranded RNA virus transmitted by the mosquitoes *Aedes aegypti* and *Aedes albopictus*. Dengue is an endemic disease in 140 countries in Asia, the USA, Africa and the Eastern Mediterranean.¹³ Annually, approximately 100 million symptomatic dengue infections occurred around the world and 75% of them occurred in Asia and the Western Pacific region.¹⁴ In this study, prevalence of dengue fever in suspected cases was 5.2%. A study conducted by Aguiar et al. in Brazil enrolled 1284 suspected dengue cases, among them 41 were positive for dengue serological test and

the prevalence was 3.10%.¹⁵ It was very close to the present study finding. In North India Garg *et al* enrolled 1227 clinically suspected dengue cases, among them 242 were positive for dengue serological test and the prevalence was 19.70%.¹⁶ In another study in Nepal, Lamsal *et al.*¹⁷ found relatively higher prevalence (48.40%) of dengue fever among their dengue suspected cases. This scenario indicates that the prevalence of dengue varies place to place depend upon the degree of presence of risk and protective factors of dengue fever in a community. The prevalence may also vary due to variation of the diagnostic criteria of suspected cases of dengue fever.

Historically, dengue cases in Bangladesh have been clustered around the 3 largest cities—Dhaka, Chittagong, and Khulna.^{18,19} A nationally representative serostudy conducted between 2014 and 2016, found that only 3% of individuals in the north had a history of prior infection with dengue, compared with >80% in Dhaka and Chittagong.¹⁸ However, this landscape is changing rapidly, as more recent outbreaks have seen cases reported from across the country. Last year (2023), all districts in Bangladesh have reported dengue cases. Notably, there has been a sharp increase in cases in the south central and northern parts of the country. The present study also revealed that now dengue fever is an emerging mosquito borne disease in rural northern part of Bangladesh.

In the present study, majority (83.30%) of the dengue positive cases were male. This finding was comparable with other studies conducted by Ranjeeta *et al.*²⁰ (81.90% were male), Rafi *et al.*²¹ (69.60% were male) and Prattay *et al.*²² (68.75% were male). This male predominance may be due to higher exposure of male to the

endemic area than female. Another possibility, this difference could reflect case selection bias as most studies were hospital-based, with male patients prevalent in developing countries, such as Bangladesh.

This study revealed that the number of dengue positive cases were significantly higher among adults and older adults (>40 years) than young adults and children (≤40 years). Similarly the mean age of the dengue infected cases was significantly higher than dengue negative cases ($P=0.002$). These study findings suggest, older adults were more infected by dengue fever than younger. This finding goes in favour of the recently reported age trends of dengue fever incidence, i.e. age shifting of dengue fever incidence from young adults (21 to 40 years) to adults and older adults (>40 years).²³

Among all dengue patients, the majority had more than four family members (58.30%) and educational qualification up to primary (58.30%). Majority (61.50%) of patients had a monthly income of less than 20,000 BDT. These findings were comparable to the findings of Mahmood *et al.*, among all their dengue patients, the majority (58.60%) had more than four family members.²⁴ In another study conducted by Ranjeeta *et al.*²⁰ it was found that 68.50% of their dengue patients in low socioeconomic status which was also consistent with the finding of this study.

Headache, myalgia, retro-orbital pain, abdominal pain, vomiting, arthralgia, gum bleeding, epistaxis, lethargy, melena and skin rash were the common clinical features identified as the important predictors of dengue in different studies.²⁵⁻²⁷ In this study, the presence of common clinical features of dengue fever except myalgia and arthralgia were not statistically associated with the dengue fever.

Simultaneously in multivariate analysis, none of the clinical features were identified as a independent predictor of dengue fever. It may be due to recall bias or error or due to generous selection criteria for the study population, i.e. suspected case of dengue fever.

The present study noticed two important epidemiological shifting of dengue fever. First one, dengue fever also prevalent in rural area. This is a warning message to the health authority of Bangladesh, because generally dengue is an urban disease. But this study suggested that dengue is also prevalent in rural Rajshahi. To mitigate the spread of the dengue, there should be strengthening vector control measures, which involve intensified insecticide spraying and precise eradication of mosquito breeding sites. Simultaneously, an extensive public awareness campaign should be strengthening to educate the general rural population about the intricacies of dengue and the implementation of preventive measures. Second one, dengue is experiencing a demographic shift to older ages. As a result it is increasing the disease burden to the adult population as well as its clinical management of the subgroup becomes very challenging. Clinicians should be cautious of the potential interactions between the elderly patient's chronic co-morbidities, medications and the clinical course of dengue.

References

1. Kuno G. Emergence of the Severe Syndrome and Mortality Associated with Dengue and Dengue-Like Illness: Historical Records (1890 to 1950) and Their Compatibility with Current Hypotheses on the Shift of Disease Manifestation. *Clin Microbiol Rev* 2009;22(2):186–201. <https://journals.asm.org/doi/10.1128/C-MR.00052-08>
2. Waggoner, J.J., et al., Viremia and Clinical Presentation in Nicaraguan Patients Infected With Dengue Virus. *Clinical Infectious Diseases*, 2016. 63(12): 1584-90.
3. Subarna R T, Saiyan Z A. Understanding the unprecedented 2023 dengue outbreak in Bangladesh: a data-driven analysis. *IJID Regions* 2024;12, Article 100406, <https://doi.org/10.1016/j.ijregi.2024.100406>
4. Anonymous. Single-day dengue deaths hit 9. New age 2024 octo 12. <https://www.newagebd.net/post/country/247621/single-day-dengue-deaths-hit-9>
5. Jagtap S, Pattabiraman C, Sankarados A, Krishna S, Roy R. Evolutionary dynamics of dengue virus in India. *PLoS Pathog*. 2023 Apr 3;19(4):e1010862. doi: 10.1371/journal.ppat.1010862. PMID: 37011104; PMCID: PMC10101646.
6. Guha-Sapir D, Schimmer B. Dengue fever: new paradigms for a changing epidemiology. *Emerg Themes Epidemiol*. 2005 Mar 2;2(1):1. doi: 10.1186/1742-7622-2-1. PMID: 15743532; PMCID: PMC555563.
7. U.S. centers for Disease Control and prevention (2024, June 5). Clinical Features of Dengue. <https://www.cdc.gov/dengue/hcp/clinical-signs/index.html>
8. Nimmagadda SS, Mahabala C, Boloor A, Raghuram PM, Nayak U A. Atypical Manifestations of Dengue Fever (DF) - Where Do We Stand Today? *J Clin Diagn Res*. 2014; 8(1):71-3. doi: 10.7860/JC-DR/2014/6885.3960. Epub 2013 Jan 12. PMID: 24596727; PMCID: PMC3939591.

9. Mohan K, Malaiyan J, Nasimuddin S, Devasir R, Meenakshi-Sundaram P, Selvaraj S, et al. Clinical profile and atypical manifestation of dengue fever cases between 2011 and 2018 in Chennai, India. *J Fam Med Prim Care* 2020;9(2):1119–23.
10. Asish PR, Dasgupta S, Rachel G, Bagepal-ly BS, Girish Kumar CP. Global prevalence of asymptomatic dengue infections - a systematic review and meta-analysis. *Int J Infect Dis.* 2023;134:292–8.
11. Man O, Kraay A, Thomas R, Trostle J, Lee GO, Robbins C, et al. Characterizing dengue transmission in rural areas: A systematic review. *PLoS Negl Trop Dis.* 2023;17(6),e0011333.
12. Tantawichien T, Thisayakorn U. Dengue. *Neglected Tropical Diseases - South Asia.* 2018;329-348. Published 2018 Mar 20. doi:10.1007/978-3-319-68493-2_10
13. Trivedi S, Chakravarty A. Neurological Complications of Dengue Fever. *Curr Neurol Neurosci Rep* . 2022 Aug 21;22(8):515–29. <https://link.springer.com/10.1007/s11910-022-01213-7>
14. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. *Nature.* 2013 7;496(7446):504–7. <https://www.nature.com/articles-nature12060>
15. de Aguiar DF, de Barros ENC, Ribeiro GS, Brasil P, Mourao MPG, Luz K, et al. A prospective, multicentre, cohort study to assess the incidence of dengue illness in households from selected communities in Brazil (2014–2018). *Int J Infect Dis.* 2021;108:443–53.
16. Garg A, Garg J, Rao YK, Upadhyay GC, Sakhuja S. Prevalence of dengue among clinically suspected febrile episodes at a teaching hospital in North India. *J Infect Dis Immun.* 2011;3(5):85–9. <http://www.academicjournals.org/JIDI>
17. Lamsal DK, Chaurasiya PS, Khatri A, Karki S, Singh S, Shilpakar G, et al. Dengue among Suspected Patients Admitted to Department of Medicine of a Tertiary Care Centre: A Descriptive Cross-sectional Study. *J Nepal Med Assoc* 2023 1;61(258):132–6. <https://jnma.com.np/jnma/index.php/jnma-/article/view/8033>
18. Salje H, Paul KK, Paul R, et al. Nationally-representative serostudy of dengue in Bangladesh allows generalizable disease burden estimates. *eLife* 2019; 8:e42869. 8.
19. Banu S, Hu W, Hurst C, Guo Y, Islam MZ, Tong S. Space-time clusters of dengue fever in Bangladesh. *Trop Med Int Health* 2012; 17:1086–91.
20. Nayak R, Panda M, Padhy S, Mishra K. Paradigm Shift in Socio-Demographic Profile of Dengue Infection: A Hospital Based Cross-Sectional Study. *J Fam Med Prim Care* [Internet]. 2021;10(6):2405. https://journals.lww.com/jfmpc/Fulltext/2021/10060/Paradigm_Shift_in_Socio_Demographic_Profile_of.47.aspx
21. Rafi A, Mousumi AN, Ahmed R, Chowdhury RH, Wadood A, Hossain G. Dengue epidemic in a non-endemic zone of Bangladesh: Clinical and laboratory profiles of patients. Diemert DJ, editor. *PLoS Negl Trop Dis.* 2020 13;14(10):e0008567. <https://dx.plos.org/10.1371/journal.pntd.0008567>

22. Prattay KMR, Sarkar MR, Shafiullah AZM, Islam MS, Raihan SZ, Sharmin N. A retrospective study on the socio-demographic factors and clinical parameters of dengue disease and their effects on the clinical course and recovery of the patients in a tertiary care hospital of Bangladesh. Ngondi JM, editor. PLoS Negl Trop Dis. 2022 4;16(4):e0010297. <https://dx-plos.org/10.1371/journal.pntd.0010297>
23. Lin R J, Leea TH, Leo Y S. Dengue in the elderly: a review. Expert review of anti-infective therapy 2017; 15(8): 729–35. <https://doi.org/10.1080/14787210.2017.1358>
24. Mahmood R, Benzadid MS, Weston S, Hossain A, Ahmed T, Mitra DK, et al. Dengue outbreak 2019: clinical and laboratory profiles of dengue virus infection in Dhaka city. Heliyon. 2021;7(6):e07183. <https://linkinghub.elsevier.com/retrieve/pii/S240584402101286X>
25. Khan MAS, Al Mosabbir A, Raheem E, Ahmed A, Rouf RR, Hasan M, Alam FB, Hannan N, Yesmin S, Amin R, Ahsan N, Anwar S, Afroza S, Hossain MS. Clinical spectrum and predictors of severity of dengue among children in 2019 outbreak: a multicenter hospital-based study in Bangladesh. BMC Pediatr. 2021;21(1):478. doi: 10.1186/s12887-021-02947-y. PMID: 34715835; PMCID: PMC8555185.
26. Chen C-H, Huang Y-C, Kuo K-C, Li C-C. Clinical features and dynamic ordinary laboratory tests differentiating dengue fever from other febrile illnesses in children. J Microbiol Immunol Infect. 2018;51(5):614–20. doi: 10.1016/j.jmii.2016.08.018.
27. Ahmed S, Arif F, Yahya Y, Rehman A, Abbas K, Ashraf S, et al. Dengue fever outbreak in Karachi 2006 - a study of profile and outcome of children under 15 years of age. J Pak Med Assoc. 2008;58(1):4–8.