Review Article

Epidemiological Analysis of Dengue : A Review

Bishnu P. Marasini[1]*, Sudip Bhandari[1], Santosh Khanal[1], Sunil Shrestha[1]
[1]Department of Biotechnology, National College, Khusibu, Nayabazar.

ABSTRACT

Introduction:
Dengue is a mosquito-borne viral disease that is spreading in tropical and subtropical regions. Dengue virus is transmitted by means of vector, which is female mosquitoes of the species Aedes aegypti and, to a lesser extent, A. albopictus. There are mainly 4 serotypes of the virus that cause dengue (DEN-1, DEN-2, DEN-3 and DEN-4) has been reported from Nepal.

Methodology:
The data was collected from the different sources including from Governmental authorities also. A descriptive data analysis was performed using Microsoft excel and SPPS version 23. The annual cases of dengue were also analyzed and represented using graphs and pie chart.

Result and Discussion:
The positive cases record as provided by the Department of Health Services, Nepal, in the last 10 years a total of 31 different districts reported the confirmed dengue cases. The number of positive cases and rising every 4th year with severity in second and third year. The majority of cases have been reported from Chitwan.

Conclusion:
Cases were clustered mostly in Terai or low plain land. There seems gradual decline in number of cases, however, not due to effective treatment or management.

Key words: Dengue virus, serotypes, Pie- chart, SPSS.

INTRODUCTION

Dengue is now currently regarded globally as the most emerging and important mosquito-borne viral disease caused by dengue virus (DENV). Dengue is an endemic viral disease affecting tropical and subtropical regions around the world, predominantly in urban and semi urban areas. Significant geographical expansion has been coupled with rapid increase in incident cases, epidemics and hyperendemicity (Murray, 2013). Dengue fever (DF) and its more serious forms, dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), are becoming important public health problems and were formally included within the disease portfolio of the United Nations Development Programme /World Bank/ World Health Organization Special Programme for Research and Training in Tropical Diseases by the Joint Coordination Board in June 1999 (World Health Organization, 2016).
The World Health Organization(WHO) estimates that there may be 50 million to 100 million cases of dengue virus infections worldwide every year, which result in 250,000 to 500,000 cases of DHF and 24,000 deaths each year (Green and Vaughn, 1999).
The Symptoms, which usually begin four to six days after infection and last for up to 10 days, may include

- Sudden, high fever
- Severe headaches
- Pain behind the eyes
- Severe joint and muscle pain

Symptoms are mild and sometimes can be mistaken for those of the flu or another viral infection. Younger children and people who have never had the infection before tend to

* **Correspondence :** Dr. Bishnu Pd. Marasini
bishnu.marasini@gmail.com

have milder cases than older children and adults. However, serious problems can develop if the disease condition is not treated earlier which include dengue hemorrhagic fever, a rare complication characterized by high fever, damage to lymph and blood vessels, bleeding from the nose and gums, enlargement of the liver, and failure of the circulatory system. The symptoms may progress to massive bleeding, shock, and death. This is called dengue shock syndrome (DSS). This is associated with high mortality and occurs as a result of secondary infection with a different serotype (Rajapakse, 2009). People with weakened immune systems as well as those with a second or subsequent dengue infection are believed to be at greater risk for developing dengue hemorrhagic fever.

Dengue Virus Structure and Genome

DENV is a flavivirus of the family Flaviviridae. Other flavivirus in the same genus include Japanese encephalitis, Yellow fever, West Nile and tick bone encephalitis viruses. Dengue viruses are single stranded positive sense RNA viruses which directly translates proteins. The DENV genome is 11 Kb in length and encodes three structural and seven nonstructural proteins. DENV has four serotypes: DENV1, DENV2, DENV3 and DENV4. Infection with one serotype provides lifelong immunity to the infecting serotype only but has been associated with increased risk of severe dengue illness upon secondary infection with a different serotype (Potts, 2010).

The structure of the dengue virus is roughly spherical, with a diameter of approximately 50nm. The core of the virus is the nucleocapsid, a structure that is made of the viral genome along with C protein. The nucleocapsid is surrounded by a membrane called the viral envelope a lipid bilayer that is taken from the host. Embedded in the viral envelope are 180 copies of E and M proteins that span through the lipid bilayer.

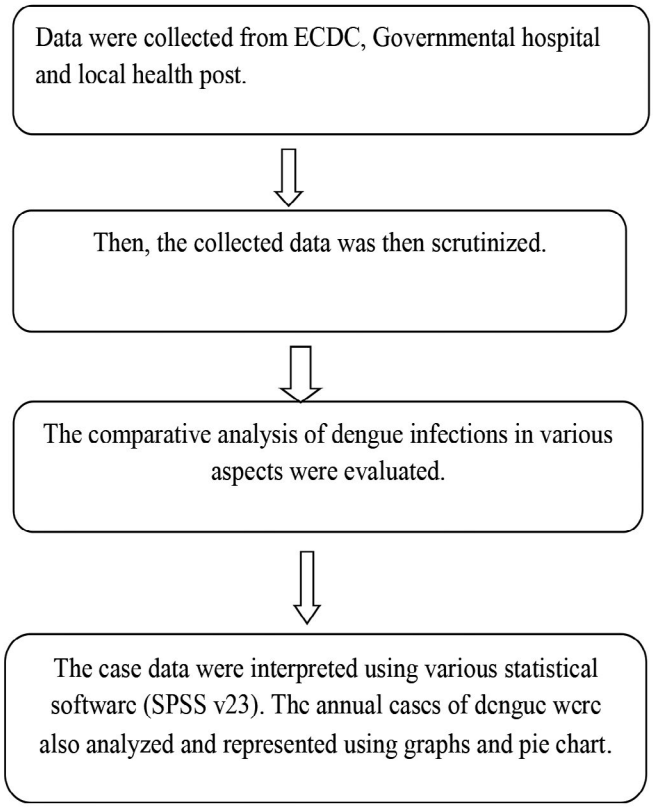
Emergence of Dengue in Nepal

Just over 50% of Nepal's current population (of nearly 28 million) resides either in a tropical or in a subtropical climate, where almost all dengue outbreaks have occurred to date. Given the annual growth rate of 1.35%, millions more individuals are set to be exposed to the threat of dengue infection in coming years.

Nepal is bordered by India in eastern, western and southern belts that is one of the countries with higher risk and so is more vulnerable to worse consequences of dengue viral infection (DVI). As with other vector borne diseases, outbreak of DF is related with increasing temperature, travel and frequent movement of people which is common due to open border between Nepal and India. DF was first reported in foreign visitor in Chitwan in 2004 (Pandey et al., 2004). Nepal reported larger outbreak in 9 districts in 2006 (WHO, 2009; EDCD, 2007). The outbreak occurred in Nepal following the Indian, Pakistan and Bhutan epidemic of DF/DHF in September- October 2006 (EDCD, 2007). The occurrence of DEN-1, DEN-2, DEN-3 and DEN-4 serotypes in the territory of Nepal augment the chances for the epidemic DF/DHF to be flourished in the country (WHO/SEARO, 2006, Takasaki et al., 2008 and Pandey et al., 2008).

At present, diagnosis and management of dengue and other infectious disease in Nepal is based on patient's clinical symptoms due to lack of diagnostic facility (Pandey et al., 2003). The threat of the DV infection in Nepal is emerging as the disease that has caused significant morbidity and mortality in the neighboring country. Though there is high risk of dengue in Nepal, there are only few studies for the sero-prevalence of the disease. This study would initiate in establishing sero-epidemiology studies and its implications for crafting appropriate future interventions of dengue in Nepal.

Method



RESULT

From the year 2063 to 2072 the positive dengue cases of 2499 were reported. The year 2067 had high number of positive dengue cases of 917 and the year 2065 have less number of dengue cases of only 10. Total of 1221 positive dengue cases were recorded within the years 2070-2073 with respected to cases from different districts of Nepal. Throughout the 3 consecutive years studies, there seems

a gradual decline in number of dengue cases. Chitwan district has consistently reported maximum number of dengue cases among the districts with positive cases of dengue. However, only 15 districts reported the cases of dengue in the fiscal year 2070/2071 while, in the fiscal year 2071/2072 only 13 districts reported the positive dengue cases. Contrastingly, in the fiscal year 2072/2073 in spite of the fact that number of cases were lower than the previous years, 27 districts had reported the incidence of positive dengue cases.

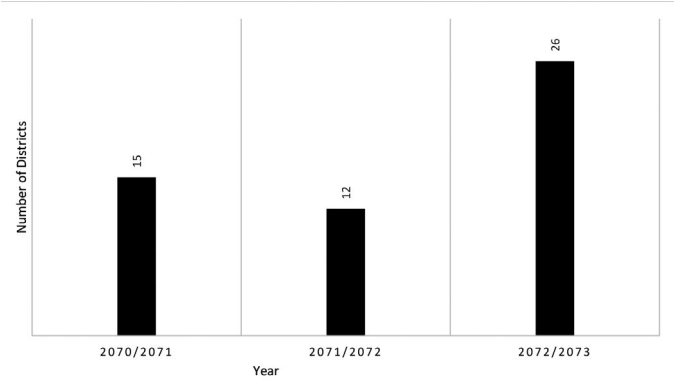


Figure: 1. Number of Districts with Positive Dengue cases in different fiscal years.

During the three-year period (2070-2073), dengue was reported in 31 of 75 districts (41%). The cases were reported from the southern Terai low plain area, bordering with India and in central Nepal. The highest average incidence of about 186 was reported in Chitwan district followed by Parsa (75), Jhapa (71) and Nawalparasi (19). The lowest incidence was reported in Dadeldhura, Kavre and in Makawanpur.

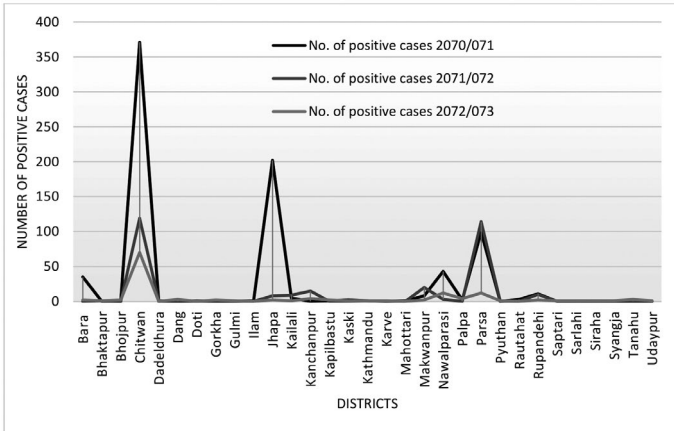


Figure: 2. Annual Distribution of positive Dengue cases in Different district of Nepal within the year 2070/071 to 2072/073.

The significance study within 10 years (from 2063 to 2072) of positive dengue cases, when analyzed by one sample t- test, which is found to be significant (P = 0.041; two tailed), which revels that there is significance difference in year wise positive dengue cases either in increasing order or in decreasing order.

DISCUSSIONS

The positive cases record as provided by the Department of Health Services, Nepal, in the last 10 years a total of 31 different districts reported the confirmed dengue cases. This study also demonstrate that Dengue incidences is not distributed homogenously in Nepal. The number of reported dengue cases has decreased significantly since 2010 with an 83 percent decrease in the last three years from 785 to 302 to 134 in the current year. The majority of cases have been reported from Chitwan and Parsa with more than 50 percent of 2072/73 cases from Chitwan.

Moreover, this kind of study and analysis of secondary data have not been in Nepal frequently. Therefore, this kind of study and analysis could be an excellent example to the future. Research result and approaches adopted here could be valuable to the public health authority to design and execute an intervention program on dengue control. However, there are some limitations with this study. Possibility of understanding due to those who did not come to health facilities for treatment and ill cooperation of private health institution in government reporting system is the first limitation of this study. Mapping and analysis on coarsely aggregated data, month and district, may have missed daily or weekly local dengue cluster is the second limitation of this study. If we had daily or weekly dengue cases at lower spatial unit (e.g. settlement, VDC, municipality), we could detect outbreak dynamics and movement of hotspots. Thirdly, this study only analyzed distribution and did not analyze possible environmental risk factors associated with clustering and therefore we could not pinpoint such risk factors.

CONCLUSIONS

Epidemics, infectious disease are generally caused by a change in the ecology of the host population. It spreads rapidly and extensively by infection and affecting many individuals in an area or a population at the same time. The distribution of dengue cases was found clustered in Chitwan and in Jhapa districts. The results of this study are not only to provide an initial risk assessment but also lay foundation to pursue further investigation into the environmental risk factors. The method adopted here can be used for other diseases. The results of this study may assist health authorities to develop better preventive strategies and increase public interventions effectiveness.

REFERENCES

1. Acharya, B. K., Cao, C., Lakes, T., Chen, W., & Naeem, S. (2016). Spatiotemporal analysis of dengue fever in Nepal from 2010 to 2014. *BMC Public Health*, *16*(1), 849. https://doi.org/10.1186/s12889-016-3432-z

2. Das, S., & Thakral, A. (2016). Predictive Analysis of Dengue and Malaria. *International Conference on Computing, Communication and Automation (ICCCA2016)*, 172–176. https://doi.org/10.1109/CCAA.2016.7813712

3. Devi, B. R., Rao, K. N., Setty, S. P., & Rao, M. N. (2013). Disaster prediction system using IBM SPSS data mining tool. *International Journal of Engineering Trends and Technology (IJETT)*, *4*(August), 3352–3357.

4. Dhimal, M., Ahrens, B., & Kuch, U. (2015). Climate change and spatiotemporal distributions of vector-borne diseases in Nepal - A systematic synthesis of literature. *PLoS ONE*, *10*(6), 1–31. https://doi.org/10.1371/journal.pone.0129869

5. Dumre, S. P., Shakya, G., Na-bangchang, K., Eursitthichai, V., Grams, H. R., Upreti, S. R., … Fernandez, S. (2013). Short Report : Dengue Virus and Japanese Encephalitis Virus Epidemiological Shifts in Nepal : A Case of Opposing Trends, *88*(4), 677–680. https://doi.org/10.4269/ajtmh.12-0436

6. Hasan et al, (2016) Dengue Virus: A Global human threat: Review of literature. J Int soc Prev Community Dent: 6(1).

7. Klein, D. E., Choi, J. L., & Harrison, S. C. (2013). Structure of a Dengue Virus Envelope Protein Late-Stage Fusion Intermediate. *Journal of Virology*, *87*(4), 2287–2293. https://doi.org/10.1128/JVI.02957-12

8. Murray NEA, Quam MB, Wilder SA, (2013) Epidemiology of dengue: Past, present and future prospects. Clin Epidemiol: 5(1): 299–309.

9. Natasha E, Murray A, et. al., (2013). Epidemiology of Dengue: past, present and future prospects. Clin Epidemiol: 299-309.

10. Potts, J. A. (2010). Description, Classification, and Prediction of Dengue Illnesses in a Thai Pediatric Cohort: A Dissertation. Retrieved from http://escholarship.umassmed.edu/gsbs_diss%5Cnhttp://escholarship.umassmed.edu/gsbs_diss/465

11. Pun SB, (2012) Dengue: An emerging disease in Nepal. *A journal of Medical Association,* 51 (184): 203-208

12. Raquel L, et. al., (2011) Comparative evolutionary epidemiology of Dengue virus serotype. 12 (2): 152-155

13. Shu PY, and Huang JH. (2004) Current advances in dengue diagnosis, *Clinical and Diagnostic Laboratory Immunology*, 642–50

14. Subedi, D., & Taylor-Robinson, A. W. (2016). Epidemiology of Dengue in Nepal: History of incidence, current prevalence and strategies for future control. *Journal of Vector Borne Diseases*, *53*(1), 1–7.

15. Summary, E. (1996). Executive Summary, *21*(1), 2–5. https://doi.org/10.1111/1468-0319.00048

16. WHO (2017) Dengue: guidelines for patient care in the Region of the Americas, Second edition. [Online]

17. http://iris.paho.org/xmlui/handle/123456789/31207.

18. WHO (2017) Dengue and sever Dengue [Online]

19. http://www.who.int/mediacentre/factsheets/fs117/en/.

20. DOHs (2072/2073) "Annual Report". Department of Health services, Kathmandu, Nepal.:p/pp