



Granger Causality between Dengue Positive Cases Reported and Health Expenditures (A Case Study from Pakistan)

Muhammad Ayaz, Ghazala Rizwani and Muhammad Nayaz*

ABSTRACT

This paper mainly aimed to interrogate the unidirectional causality from dengue positive cases reported in Pakistan to health expenditure of Pakistan. The data for the years ranging from (2006-2014) was deployed to test the proposition used while; unidirectional causality from dengue positive cases reported to health expenditure was investigated through granger causality test. Findings confirmed that neither the dengue positive cases reported in Pakistan granger causes to an increase in health expenditure of Pakistan nor the increase in health expenditure of Pakistan granger causes negatively to the dengue positive cases imply that despite of the good numbers of dengue positive cases in the country, the Govt. of Pakistan did not bother to allocate a sufficient budget for it under the head of Govt. expenditures, whereas, insufficient allocation of money to counter the infectious diseases has never been able to cow down the infectious diseases like dengue infection in this country.

Keywords: Dengue Positive Cases, Health Expenditures.

JEL Classification: H51

Introduction

A viral infection commonly known as “Dengue” is transmitted through mosquitoes named *Aedes aegypti* and *Aedes Albopictus*. It is one of the pandemic viral diseases also known as break bone fever. World Health Organization statistics showed that dengue fever is peculiar in more than hundred countries and about forty percent of population around the globe is at a higher risk. This infectious disease is now being recognized in all parts of the world as fifty to hundred million and cases up to five lacs of dengue hemorrhagic fever are reported per annum. WHO reported 0.4 to 1.3 million numbers of cases in the decade 1996-2005 per annum. The number of cases varies every year. Misdiagnosis and under reporting cases are the major hurdles in determining the maximum burden of Dengue and its prevalence. The various modes of Dengue in developing countries are unsafe drinking water, poor sanitation, crowded population and poor health and medical facilities.

* Corresponding author’s email: m.ayaz@abbott.com (Abbott), ghrizwani@uok.edu.pk (University of Karachi), nayazsubhani_edu@yahoo.com (Iqra University)

* The material presented by the author does not necessarily portray the view point of the editors and the management of the Iqra University, Karachi.

Dengue has become a renowned infectious and diffusible disease in the Indian sub continent, including the countries such as Pakistan, India, Bangladesh and Sri Lanka. The climate of a place has a vital role to play in the spread of dengue fever and dengue hemorrhagic fever. The Indian sub continent receives extended annual monsoon period from July to September. During these months, water in the pools and stagnant water after the rain produces *Aedes Aegypti* and promotes maximum breeding while the humid environment and steady temperature up to mid 30 degree centigrade also contributes to the increasing vector population.

Dengue lays significant health and economic burden on the population of endemic areas. Various studies to estimate the cost of illness due to dengue have been conducted at different parts of the world in the past. In the developing countries where majority of the dengue cases are reported, the burden may be higher due to less financial resources, inadequate water supply and poor infra-structure as compared to the developed ones (Beaute & Vong, 2010).

This study has investigated the impact of dengue outbreaks on the health expenditure of Pakistan.

Literature Review

dengue is caused by a fever and is most found in the tropical weathers around the world. The fever is generally caused by Flavivirus. Dengue is characterized by headache, fever, muscular or joint pain, bleeding, arthralgia, myalgia, skin rash, nausea and vomiting. The economic burden of this disease is of greater significance particularly in developing countries with limited amount of resources. The cost of disease on the public indicated factors for instance encompasses sickness, decreased or absent income of patients and their families, lab facilities and drugs. Including the above mentioned cost of illness, other expenditures are also incurred by the government on public health activities including cleaning campaigns, health education and surveillance and fumigation to minimize the risk. Dengue is a lethal virus which has created an unexpected arousal in the health care expenditures in various parts of the world. This literature review discusses the pecuniary burdens on households and government, faced by many countries of the world after substantial dengue fever outbreaks.

Clark, Mammen, Nisalak, Puthimethee, and Endy (2005) examined the impact of dengue and dengue hemorrhagic fever on the families and population, living in Kamphaeng Phet, a province of Thailand by a survey conducted in 2001. The study population included confirmed dengue positive cases recorded by various hospitals of the province. They found that the total health expenditure at families' level of dengue patients in Kamphaeng Phet was 1026 Baht or US\$24 at an average.

Okanurak, Sornmanis, and Indaratnak (1997) examined the burden of cost on patients, who were labeled as dengue positives in 1994. The inconvenience in the form of cost was reported by the caretakers of patients', who were with them. The research was conducted at Children hospital, Bangkok, Suphan Buri province hospital and Don Chedi community hospital situated at Don Chedi district in Suphan Buri province in which the amount spent on prevention and control was calculated from the reports presenting the budget of Department of Ministry of interior and public health, amounting to US\$4.8724 million (Kongsin, Jiamton, Suaya, Vasanawathana, Sirisuvan, & Shepard, 2010). Okanurak, Sornmanis, and Indaratnak (1997) found that the total health cost for dengue in 1994 was nearly US\$12.596 million, the budget of government shared 54.8% and the rest 45.2% was the health care expenses paid by 51688 dengue patients and their families.

In another study Lim, Vasan, Birgelen, Murtola, Gong, Field, Mavalankar, Ahmad, Hakim, Murad, Wan, Chai See, Suaya, and Shepard (2010) examined the average annual cost

of dengue in Malaysia and Thailand for the periods of 2002-2007 and 2000-2005 respectively. The factors comprised of research and development cost, charge of non-fatal illness, mosquitoes control costs, and incurred by government institutions.

Lim, Vasan, Birgelen, Murtola, Gong, Field, Mavalankar, Ahmad, Hakim, Murad, Wan, Chai See, Suaya, and Shepard (2010) found that in Malaysia the cost of dengue varies from US\$88 million to US\$215 million with mean of US\$133 million per annum and in Thailand the cost of dengue was in the range of US\$56 million to US\$264 million with mean of US\$135 million per annum. They found that the total number of dengue cases in Thailand was 3.6 times more than in Malaysia but the cost per case of dengue was 4.6 times higher than Thailand. Moreover, the cost due to dengue was 11 times bigger than the amount spent by the government in Malaysia and about 13 times more than the amount spent by the government in Thailand. Hence, it was concluded that the government spending was lesser on health than expected and that an increase investment on prevention and control could reduce the illness cost of dengue patients in both the countries.

Harving and Ronsholt (2007) found that the average cost of a family who had dengue hemorrhagic fever was US\$61.36 of which US\$32.73 was direct cost and US\$28.73 was indirect cost. They concluded that dengue hemorrhagic fever resulted in large expenses paced by families in South Vietnam and therefore it is considered as socio-economic burden in the country. Similar studies have been conducted for Cambodia by Damme, Leemput, Por, Hardeman and Meessan (2004), which examined that dengue outbreaks are out of pocket health expenditure.

Damme, Leemput, Por, Hardeman and Meessan (2004) found that the households who had used private sources on average, paid US\$103 as compared to both private and public health providers, which on average paid US\$32 and the households used only public hospitals and paid US\$8. As Cambodia is a poor country, after dengue outbreaks most of the households took loan and some sold their properties to bare the health care expenses. This showed that the government of Cambodia has not invested well on dengue prevention and controlling measures. They concluded that in Cambodia, the situation has worsened than in many under developing countries. This was because of the poor pattern and functioning of health care systems and such cases usually occur in countries where public and private health care practice is unregulated. Damme, Leemput, Por, Hardeman and Meessan (2004) suggested that safety nets and third party health care costs for the poor i.e. Equity health funds should be introduced and if considered can play a vital role socio-economically.

In another study by Armien, Suaya, Quiroz, Sah, Bayard, Marchena, Campos, and Shepard (2008) stated that in the year 2005, Panama went through the extensive dengue epidemic since 1993. The patients were systematically selected and were laboratory confirmed cases of dengue. They took ambulatory patients 130 of 136 participants with adults 82% (above 18) and Women 62%. Patients interview was taken observing the impact of dengue on health, out of the pocket health expenditure and income lost. Clinical features included the Symptoms and signs of disease, direction of fever and illness, Perceived severity and quality of life.

Armien, Suaya, Quiroz, Sah, Bayard, Marchena, Campos, and Shepard (2008) found that on average ambulatory and hospitalized cases, the cost was US\$332 and US\$1065 respectively. Although 5489 dengue cases were reported officially, ministry of health found actual cases up to 32,900, intimating entire cost of US\$11.8 million. The government was spending US\$5 million estimate. Hence, the dengue epidemic, laid a significant impact and a huge economic cost of US\$16.9 million (\$ 5.22 per capita).

In a research Murtola, Vasan, Puwar, Govil, Field, Gong, Vayas, Suaya, Howard, Shepard, Kholi, Prajapati, Singh, and Mavalankar (2010) examined the direct cost of dengue and chikungunya in Gujrat India. Chikungunya is a vector borne disease with similar symptoms like dengue. The key factors that indicated direct cost of dengue and chikungunya

in the society were the cost of non-fatal illness and the cost of intervention program that included dengue mosquito control, household insecticides and cost for research and development. Cost of illness was estimated by dengue reported cases for the last six years 2003-2008 and chikungunya cases reported for the period of 2006-2008.

Murtola, Vasana, Puwar, Govil, Field, Gong, Vayas, Suaya, Howard, Shepard, Kholi, Prajapati, Singh, and Mavalankar (2010) found that the total number of dengue cases reported by National vector borne disease control programmed has increased since 2004. In the last six years for 2003-2008; the reported cases of dengue varied from 117 to 1023 with an annual average of 493. They found that the immediate cost of dengue and Chikungunya incurred by Households had been 3.8 billion INR per annum and after adding relative number of cases in each state, they found that the mean cost of these two diseases to the whole India was approximately 61 billion INR that ranged from 26-148 billion INR. These estimations translated to approximately INR 67 per capita or US\$ 1.6 per capita with comparable cost of dengue in other countries US\$5.3 in Malaysia and US\$6.2 in Panama.

In another study Garg, Nagpal, Khairnar, and Seneviratne (2008) examined the economic burden of dengue infections in India. Data was collected from patients having positive dengue label, at a Hospital in Northern India from Sep-Nov 2006. Findings of each patient were recorded on a standard Performa. The expenditure that a patient faced was calculated by summing the cost of investigations, room charges, drugs, disposables and physician time obtained from the hospitals electronic receipt database. Moreover, the cost charged by nursing homes that are privately running for 10 years or above in the region were also studied to determine the cost of private Sector. Total cost that the private sector charged was observed to be almost two-third of the health care expenses at the tertiary private hospitals. The positive cases with disease and deaths during the dengue epidemic 2006 were also collected.

Garg, Nagpal, Khairnar, and Seneviratne (2008) found that the total average economic burden that is adjusted for all potential variables that influenced the cost of private and the public sector hospitals was evaluated as US\$ 27.4 million. The average burden at private sector was estimated as US\$ 21.7 Million and at public sector US\$ 5.7 million expectedly. The burden that the public sector bear was only 21 % of the total cost incurred. The statistics showed that government was spending very less in order to fight with the disease.

Hypotheses

H1: There is the unidirectional causality from dengue positive cases reported in Pakistan to health expenditure of Pakistan

H2: There is the unidirectional causality from health expenditure of Pakistan to dengue positive cases reported in Pakistan.

Descriptions of Data and the Model

For evaluating the formulated hypothesis/ proposition, the empirical data for dengue positive cases have been obtained from dengue surveillance cell in Sind patronized by Govt. of Sindh. The handbook of Statistics of Pakistan Economy is used for the data of health expenditure, which was retrieved from the online portal of State bank of Pakistan. The data for the years ranging from (2006-2014) was used for dengue positive cases reported in Pakistan and Health Expenditures allocated in the fiscal budget of Pakistan. The unidirectional causality from dengue positive cases to health expenditure and then from health expenditure to dengue positive cases were interrogated through deploying Granger Causality test via the data extracted as stated.

$$\text{Health Expenditure}_t = \alpha_t + \beta_1 \text{ Dengue Positive Cases}_{t-1} + \varepsilon_t \text{----- Eq.01}$$

$$\text{Dengue Positive Cases}_t = \alpha_t + \beta_2 \text{ Health Expenditure}_{t-1} + \varepsilon'_t \text{----- Eq.02}$$

Where,

α_t = Intercept of the equation 01

α'_t = Intercept of the equation 02

β_1 = Increase/ decrease in health expenditure due to dengue positive cases.

β_2 = Increase/ decrease in dengue positive cases due to health expenditure.

ε_t = Error term of the equation 01

ε'_t = Error term of the equation 02

Findings and Hypotheses Assessment Summary

Hypotheses	F-Statistics	Empirical Conclusion
H1: There is the unidirectional causality from dengue positive cases reported in Pakistan to health expenditure of Pakistan	0856	Rejected
H2: There is the unidirectional causality from health expenditure of Pakistan to dengue positive cases reported in Pakistan.	0.746	Rejected
No of Observations= 09; Lag= 01		

It is revealed in the findings that unidirectional causality from dengue positive cases reported in Pakistan to health expenditure of Pakistan was not found and observed which implies that dengue positive cases are the causes for affecting the health expenditures allocated in the annual federal budget of Pakistan. While no unidirectional causality was observed from health expenditure of Pakistan to dengue positive cases reported in Pakistan.

Discussion

The findings of this research are parallel to various other researches carried out in under developed countries like Pakistan. Lim, Vasan, Birgelen, Murtola, Gong, Field, Mavalankar, Ahmad, Hakim, Murad, Wan, Chai See, Suaya, and Shepard (2010) confirmed that the cost of dengue is eleven times greater than the amount of Government spending in Malaysia and thirteen times than the amount of Government spending in Thailand means the dengue cases have never been given the importance in theses stated regions by the concerned governance, as has been observed for the Pakistani space.

Damme, Leemput, Por, Hardeman and Meessan (2004) found that due to poor and uncertain health care systems and less government spending on dengue, Cambodia faced heavy loss socio economically. Garg, Nagpal, Khairnar, and Seneviratne (2008) found that in India, public sector spending is only US\$ 5.7 million while the total economic burden was US\$ 27.4 million due to the menace of dengue.

Policy Implication

This paper suggests that appropriate and careful considerations should be given to the threat of dengue through allocating a substantial allocation of Government spending in the fiscal budget for the welfare and wellbeing of public in Pakistan.

References

- Armien, B., Suaya, J. A., Quiroz, E., Sah, B. K., Bayard, V., Marchena, L., Campos, C., & Shepard, D. S. (2008). Clinical Characteristics and National Economic Cost of the 2005 Dengue Epidemic in Panama. *The American Journal of Tropical Medicine and Hygiene*, 79(3), 364-371.
- Beaute, J., & Vong, S. (2010). Cost of disease burden of dengue in Cambodia. *Bio Med Central Public Health*, 10(521), 1-6.
- Clark, D. V., Mammen, M. P., Nisalak, A., Puthiethee, V., & Endy, T. P. (2005). Economic Impact of Dengue fever/Dengue Hemorrhagic fever in Thailand in family and population level. *The American Journal of Tropical Medicine and Hygiene*, 72(8), 117-121.
- Damme, W. V., Leemput, L. V., Por, I., Hardeman, W., & Meessen, B. (2004). Out-of-Pocket health expenditure and debt in poor households: evidence from Cambodia. *Tropical Medicine and International Health*, 9(2), 273-280.
- Garg, P., Nagpal, J., Kharnar, P., & Seneviratue, S. L. (2008). Economic burden of Dengue infections in India. *Transactions of the royal society of tropical medicine and hygiene*, 102(6), 570-577.
- Harving, M. L., & Ronsholt. F. F. (2007). The economic impact of dengue hemorrhagic fever on family level in Southern Vietnam. *Danish Medical Journal*, 54(2), 170-172.
- Kongsin, S., Jiamton, S., Suaya, J. A., Vasanawathana, S., Sirisuvan, P., & Shepard, D. S. (2010). Cost of dengue in Thailand. *Dengue Bulletin*, 34, 77-88.
- Lim, L. H., Vasan, S. S., Birgelen, L., Murtola, T. M., Gong, H., Field, R. W., Mavalankar, D. V., Ahmad, N. W., Hakim, L. S., Murad, S., Wan, N. C., Chai See, L. L., Suaya, J. A., & Shepard, D.S. (2010). Immediate cost of dengue to Malaysia and Thailand an estimate. *Dengue Bulletin*, 34, 65-76.
- Murtola, T. M., Vasan, S.S., Puwar, T. I., Govil, D., Field, R. W., Gong, H., Vayas, A. B., Suaya, J. A., Howard, M., Shepard, D. S., Kholi, U. K., Prajapati, P.B., Singh, A., & Mavalankar, D. V. (2010). Preliminary estimate of immediate cost of Chikungunya and dengue to Gujrat, India. *Dengue Bulletin*, 34, 32-39.
- Okanurak, K., Sornmani, S., & Indaratna, K. (1997). The Cost of dengue hemorrhagic fever in Thailand. *The Southeast Asian Journal of tropical medicine and public health*, 28(4), 711-717.