

## A Costing Methodology for Dengue

<sup>1</sup>A.C. Er, <sup>1</sup>M.E. Toriman, <sup>2</sup>Rozita Hod, <sup>1</sup>Sharifah Mastura Syed Abdullah,  
<sup>3</sup>Mazrura Sahani, <sup>3</sup>Hidayatulfathi Othma, <sup>2</sup>Saperi Sulong, <sup>2</sup>Amrizal Muhammad Nur,  
<sup>4</sup>Nor Rohaizah Jamil and <sup>1</sup>Lee Qiao Yun

<sup>1</sup>School of Social Development and Environmental Studies, Faculty of Social Science and Humanities,  
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

<sup>2</sup>UKM Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, Cheras, 56000 Kuala Lumpur, Malaysia

<sup>3</sup>Faculty of Allied Health Sciences, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia

<sup>4</sup>School of Environmental and Natural Resources Sciences, Faculty of Sciences and Technology,  
National University of Malaysia, 43600 Bangi, Selangor, Malaysia

---

**Abstract:** Dengue fever and dengue haemorrhagic fever have been on an increasing trend for the past two decades. The aim of this study is to determine the cost of illness as a result of dengue fever and dengue haemorrhagic fever. The research method is based on the calculation of cost of illness. Cost-of-illness is operationalized via direct and indirect costs. Intangible costs is not taken into consideration as it is the most controversial and the hardest to measure. The cost of illness for dengue fever is RM 1,771 as compared to RM 1,805 for dengue haemorrhagic fever. The ratios of cost of illness for dengue fever and dengue haemorrhagic fever vis-a-vis the average GDP per capita for the period 2002-2008 are 8.6 and 8.8%, respectively. This is a fairly sizeable burden and if the number of patients were to increase, the financial burden on key stakeholders like the government, patients and caregivers will be even higher. Lost productivity is the only constituent in indirect costs. If data were available for other constituents like sick leave, the indirect costs and likewise the total cost of illness will even be higher. As the calculation of cost of illness is based on mean length of stay, the quantum of financial burden will even be higher if the length of stay is longer than the mean length of stay for both dengue fever and dengue haemorrhagic fever.

**Key words:** Dengue fever, dengue haemorrhagic fever, cost-of-illness, direct costs, indirect costs, Malaysia

---

### INTRODUCTION

The incidence of dengue, a vector-borne disease (Habeeb *et al.*, 2009; Vinayaka *et al.*, 2009) has grown dramatically around the world in recent decades. Nearly, 40% of the world's population lives in an area endemic with dengue. The World Health Organization estimated that 50 million cases of Dengue Fever (DF) with 500,000 cases of Dengue Haemorrhagic Fever (DHF) requiring hospitalization each year (Stephenson, 2005; Guzman and Kouri, 2002).

The disease is currently endemic in >100 countries in Africa, the Americas, the Eastern Mediterranean, South-east Asia and the Western Pacific. South-east Asia and the Western Pacific are the most seriously affected. Not only is the number of cases increasing as the disease is spreading to new areas but explosive outbreaks are occurring (McMichael, 2003). Likewise, Malaysia has seen

an increasing trend of dengue cases for the last two decades as shown in Table 1 and 2. It was estimated in 2005 that dengue typically costs Malaysia \$13 million in treatment and vector control efforts annually and that the output of 940,000 days of work is lost to the nation. Each person hospitalized with DF or DHF in Malaysia costs about \$718 to treat. However, this study does not compute the overall cost of illness by summing up direct and indirect costs. An extensive body of research and literature has focused on the Cost of Illness methodology (Mia *et al.*, 2011). The advantage of this methodology is its versatility. It can also be used in the economic valuation of specific interventions or policy measures to reduce the health burden. The aim of this research is to determine the cost of illness as a result of DF and DHF. The cost of illness in this specific case is made up of both direct and indirect costs. This determines the quantum of the financial burden borne for treating the disease.

---

**Corresponding Author:** A.C. Er, School of Social Development and Environmental Studies,  
Faculty of Social Science and Humanities, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor,  
Malaysia

Table 1: Dengue fever cases (Clinical) in Malaysia (from 1990-2005)

| Years | Dengue Fever (DF) |           | Dengue Haemorrhagic Fever (DHF) |           | Total  |           |
|-------|-------------------|-----------|---------------------------------|-----------|--------|-----------|
|       | Case              | Mortality | Case                            | Mortality | Case   | Mortality |
| 1990  | 4,235             | 0         | 645                             | 21        | 4,880  | 21        |
| 1991  | 5,888             | 0         | 740                             | 39        | 6,628  | 39        |
| 1992  | 4,828             | 0         | 645                             | 24        | 5,473  | 24        |
| 1993  | 5,060             | 0         | 555                             | 23        | 5,615  | 23        |
| 1994  | 2,877             | 0         | 256                             | 13        | 3,133  | 13        |
| 1995  | 6,156             | 0         | 387                             | 28        | 6,543  | 28        |
| 1996  | 13,723            | 2         | 532                             | 30        | 14,255 | 32        |
| 1997  | 18,642            | 3         | 787                             | 49        | 19,429 | 52        |
| 1998  | 26,240            | 18        | 1,141                           | 64        | 27,381 | 82        |
| 1999  | 9,602             | 6         | 544                             | 31        | 10,146 | 37        |
| 2000  | 6,692             | 4         | 411                             | 41        | 7,103  | 45        |
| 2001  | 15,446            | 3         | 922                             | 47        | 16,368 | 50        |
| 2002  | 30,807            | 2         | 1,960                           | 72        | 15,493 | 54        |
| 2003  | 30,220            | 4         | 1,325                           | 68        | 31,545 | 72        |
| 2004  | 32,422            | 7         | 1,473                           | 95        | 33,895 | 102       |
| 2005  | 37,612            | 0         | 2,042                           | 107       | 39,654 | 107       |

Ministry of Health, 2009

Table 2: Dengue fever cases in Malaysia (2006 till 6 June 2009)

| Years            | Cases for dengue fever | Total mortality |
|------------------|------------------------|-----------------|
| 2006             | 38,556                 | 89              |
| 2007             | 48,846                 | 98              |
| 2008             | 49,335                 | 112             |
| Till 6 June 2009 | 22,426                 | 57              |

Ministry of Health, 2009

## MATERIALS AND METHODS

This study covers the operationalization of the cost-of-illness which comprises of direct and indirect costs. Intangible costs are not included as the problem of quantification arises. The cost-of-illness is based on per episode of care or per length of stay for DF and DHF.

**Operationalization of cost of illness:** Cost of illness can be divided into 3 components (Suhrcke *et al.*, 2006).

**Direct costs:** Direct costs are medical care costs pertaining to diagnosis and treatment of disease/s. Costs associated with ambulance transportation, inpatient or outpatient care, surgery, rehabilitation and medication are classified as direct costs. This is the least controversial of the three costs. However, for this study, outpatients are excluded as data is not available. The calculation for direct costs is based on cost of treatment per episode of care or per length of stay for DF and DHF.

**Indirect costs:** Indirect costs are cost measurement in terms of the lost of human resources caused by morbidity or mortality. The measurement of indirect costs has generated much debate. Indirect costs consist of lost productivity, i.e., the effectiveness of the illness on the ability of either parents or their caregivers to work (e.g., loss in income) or engaged in other activities (cleaning the

house), absenteeism, sick leave, disability support and disability pension (e.g., SOCSO related support). As cost of treatment is based on per episode of care, no distinction is being made for working and non-working patients. As such the calculation for sick leave, disability support and disability pension cannot be carried out.

**Intangible costs:** Intangible costs are costs associated with the psychological dimensions of illness encompassing pain, bereavement, anxiety and suffering. This is the most controversial and the hardest to measure. As such, intangible costs will not be utilised to calculate the cost of illness as quantification or the development of proxies will be extremely difficult. For the purpose of this study, the direct and indirect costs are the constituents for the cost-of-illness (Mia *et al.*, 2011). The hospital selected for this study is Hospital Universiti Kebangsaan Malaysia (HUKM) as it has a system to capture information pertaining to treatment costing. As explained earlier, treatment cost is based on per episode of care or per length of stay.

## RESULTS AND DISCUSSION

**Direct costs:** From Table 3, direct costs via cost of treatment per episode of care or per length of stay for both DF and DHF are being presented. Within Table 3, the mean cost of treatment and the mean length of stay will be the foci.

The mean cost of treatment for DF is Ringgit Malaysia (RM) 1,496 for a mean length of stay of 4.9 days. In comparison with DHF, the mean cost of treatment is RM 1,524 with a mean length of stay of 5 days. The differential between DF and DHF for mean cost of treatment and mean length of stay is relatively small.

Table 3: Cost of treating dengue patient per episode of care or per length of stay for DF and DHF

|         | Dengue fever |                       | Dengue haemorrhagic fever |                       |
|---------|--------------|-----------------------|---------------------------|-----------------------|
|         | Cost (RM)    | Length of stay (days) | Cost (RM)                 | Length of stay (days) |
| Mean    | 1,496        | 4.9                   | 1,524                     | 5.0                   |
| Median  | 1,515        | 5.0                   | 1,212                     | 4.0                   |
| SD      | 657          | 2.2                   | 661                       | 2.2                   |
| Minimum | 606          | 2.0                   | 606                       | 2.0                   |
| Maximum | 4,545        | 15.0                  | 3,636                     | 12.0                  |

Suhreke *et al.* (2006)

**Indirect costs:** As mentioned before, the only constituent of indirects costs is lost productivity. Data limitation does not allow for the calculation for sick leave, disability support and disability pension. An assumption made with either to parents or caregivers is that only a parent or a caregiver is allocated for a patient. This is based on general and district hospital visitor policy that a patient is entitled to a caregiver on a 24 h basis. However, this is different for private hospital.

For lost productivity of either parents or caregivers, the average Gross Domestic Product (GDP) per capita will be used as the proxy. As the data were gathered for the period 2002-2008, the average GDP per capita for the said period will be calculated. The calculated average GDP per capita for the period 2002-2008 is RM 20,508. The equation for calculating lost productivity is:

$$\text{Lost productivity per episode of care} = \text{Average GDP per capita} \times \text{Mean length of stay}/365 \text{ days} \quad (1)$$

Lost productivity for the mean length of stay of 4.9 days for DF is:

$$\text{RM } 20,508 \times 4.9 \text{ days}/365 \text{ days} = \text{RM } 275 \quad (2)$$

Likewise, lost productivity for the mean length of stay of 5 days for DHF is:

$$\text{RM } 20,508 \times 5 \text{ days}/365 \text{ days} = \text{RM } 281 \quad (3)$$

**Total cost-of -illness:** Thus, the cost of illness for DF is:

$$\text{RM } 1,496 \text{ (direct costs)} + \text{RM } 275 \text{ (indirect costs)} = \text{RM } 1,771 \quad (4)$$

Likewise, the cost-of-illness for DHF is:

$$\text{RM } 1,524 \text{ (direct costs)} + \text{RM } 281 \text{ (indirect costs)} = \text{RM } 1,805 \quad (5)$$

On a comparative basis, the cost of illness for DF and DHF as a percentage of average GDP per capita for the

said period of 2002-2008 are 8.6 and 8.8% respectively. Both the percentages are fairly sizeable in terms of quantum and can be a financial burden for all relevant stakeholders.

## CONCLUSION

The cost of illness for DF is RM 1,771 which is slightly lower as compared to RM 1,805 for DHF. The ratios of cost of illness for DF and DHF as compared to average GDP per capita for the period 2002-2008 are 8.6 and 8.8%, respectively. This is a fairly sizeable financial burden, especially for low-income earners.

Likewise if the number of patients suffering from DF and DHF were to increase as a result of climate change and a host of other factors, the financial burden borne by the key stakeholders like the government, patients and caregivers will be even higher.

In the calculation for indirect costs, lost productivity is the only constituent. If data were to allow for the calculation of indirect costs for sick leave, disability support and disability pension, the indirect costs and likewise the total cost of illness will definitely be higher. The cost of sick leave is definitely calculable if data were available. However as DF and DHF are both a treatable disease, the probability for disability support and disability pension is relatively low unless complications developed. The quantum of financial burden will be even higher if the length of stay is longer than the mean length of stay for both DF and DHF. This would impose a greater level of stress, especially for low-income earners.

## ACKNOWLEDGEMENT

This research grant is funded by Research University Grant entitled Climate Change and Public Health: Impact and Intervention (UKM-GUP-PI-08-35-083).

## REFERENCES

- Guzman, M.G. and G. Kouri, 2002. Dengue: An update. *Lancet Infectious Dis.*, 2: 33-42.
- Habeeb, S.M., A.H. El-Namaky and M.A. Salama, 2009. Efficiency of allium cepa and cammihora molmol as a larvival agent against fourth stage larvae of culex pipiens (Diptera: Culicidae). *Am. Eurasian J. Agric. Environ. Sci.*, 5: 196-203.
- McMichael, A.J., D.H. Campbell-Lendrum, C.F. Corvalan, K.L. Ebi, A.K. Githeko, J.D. Schregga and A. Woodward, 2003. *Climate Change and Human Health: Risks and Responses*. World Health Organization, Geneva.

- Mia, M.S., R.A. Begum, A.C. Er, R.D.Z.R.Z. Abidin and J.J. Pereira, 2011. Malaria and climate change: Discussion on economic impacts. *Am. J. Environ. Sci.*, 7: 73-82.
- Ministry of Health, 2009. Vector borne disease branch public health department. Ministry of Health Malaysia.
- Stephenson, J.R., 2005. The problem with dengue. *Trans. R. Soc. Trop. Med. Hyg.*, 99: 643-646.
- Suhrcke, M., R.A. Nugent, D. Stuckler and L. Rocco, 2006. *Chronic Disease: An Economic Perspective*. Oxford Health Alliance, London.
- Vinayaka, K.S., S.P. Swarnalatha, H.R. Preethi and K.S. Surabhi, 2009. Studies on *in vitro* antioxidant, antibacterial and insecticidal activity of methanolic extract of *Abrus pulchellus* wall (Fabaceae). *Afr. J. Basic Applied Sci.*, 1: 110-116.