ASSESSING THE COST BURDEN OF DENGUE INFECTION TO HOUSEHOLDS IN SEREMBAN, MALAYSIA

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Abstract. Dengue is endemic in all parts of Malaysia. However, there is limited data regarding the cost burden of this disease at household level. We aimed to examine the cost of dengue infection at the household level in Seremban District, Malaysia. This cost assessment can provide an insight to policy-makers about economic impact of dengue infection in order to guide and prioritize control strategies. The data were collected via interview. We evaluated120 previous dengue infection patients registered at the Tuanku Ja'afar Hospital, Seremban District, Malaysia. The average duration of dengue illness was 9.69 days. The average household days lost was 18.7; students lost an average of 6.3 days of school and patients and caregivers lost an average of 12.5 days of work. The mean total cost per case of dengue infection was estimated to be USD365.16 with the indirect cost being USD327.90 (89.8% of the total cost) and the direct cost being USD37.26 (10.2% of the total cost). Our findings suggest each episode of dengue infection imposes a significant financial burden at the household level in Seremban District, Malaysia; most of the burden being indirect cost. This cost needs to be factored into the overall cost to society of dengue infection. This data can inform policy makers when allocating resources to manage public health problems in Malaysia.

Keywords: dengue, direct costs, indirect costs, households, Seremban, Malaysia

INTRODUCTION

Dengue is a major public health problem worldwide and an important re-emerging disease (Teles, 2011). It causes

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significant morbidity and mortality in most tropical and subtropical regions of the world (Huy *et al*, 2009). Dengue has also emerged in temperate regions as well (Teles, 2011). The mosquito vectors for dengue viruses have usually been found in urban and semi-urban areas (WHO, 2009a). However, over the last 50 years, the incidence of dengue has increased 30-fold, spreading to new countries, and moving into rural areas as well (Kulkarni and Kumar, 2011). Approximately 2.5

billion people live in dengue-endemic countries and an estimated 50-100 million dengue infections occur annually world-wide (WHO, 2009a). There are an estimated 500,000 cases of severe dengue infection world-wide each year, a large proportion of whom are children, and 2.5% of whom will die (WHO WPRO, 2012). Southeast Asia and the Western Pacific are particularly vulnerable to dengue infection due to large population growth, rapid urbanization and high densities of the main mosquito vector, *Aedes aegypti* (Suaya *et al*, 2007). In recent years, severe dengue infection has become a leading cause of hospitalizations and death among children in Asian countries (WHO, 2009b). The disease imposes an economic and social burden on health care systems, affected households and society at large (Suaya *et al*, 2009).

Dengue is endemic in Malaysia. The warm, humid tropical climate of Malaysia is favorable for the vector mosquitoes to breed and survive. Rapid industrialization and economic growth in Malaysia during the past few decades have resulted in massive growth and improper solid-waste management, providing a fertile environment for vector mosquitoes breeding and increased dengue transmission (Teng and Singh, 2001; Kwa, 2008). The incidence of dengue and severe dengue infections in Malaysia have increased steadily over the past decade (Azami *et al*, 2011). The disease is present throughout the country with the highest incidences being in the most developed, densely populated parts of Malaysia (Second National Communication, Malaysia, 2011). In Malaysia, the disease is more common in urban areas where the majority of the country's population resides. However, a recent study found that dengue has spread from urban to rural areas in Malaysia, including forest fringe areas where the majority of aboriginal populations reside (Abu Bakar and Lim, 2011). However, there are few studies in Malaysia about the cost of dengue infection at the household level. The few studies that have examined the cost have done it at the national level (Lim *et al*, 2010; Shepard *et al*, 2012), not the household level.

This study aims to determine the cost of dengue infection at the household level, estimating both direct and indirect costs in Seremban District, Malaysia. To our knowledge, this is the first study of this kind in Malaysia.

MATERIALS AND METHODS

Study area

Seremban (Fig 1) is one of the eight Districts of the Malaysian state of Negeri Sembilan. It is the capital of the state and occupies an area of 950.53 km² of land (Department of Statistics, Malaysia, 2011). Seremban is the sixteenth most populated city in Malaysia with a total population of 555,935 (Department of Statistics, Malaysia, 2011). The population of the District is comprised of ethnic Malays and Bumiputeras (52%), Chinese (24%), Indians (16%) and others (8%) (Department of Statistics, Malaysia, 2011). The District has a number of public and private health care facilities. There are five hospitals, one government and four private. There are also 11 public health centers serving the various zones of the District. Seremban District has a high prevalence of dengue infections (Ghazali *et al*, 2012), causing major morbidity.

Data collection

We conducted a cross-sectional survey of households in the study area. The households were selected based on having a member registered at the Tuanku Ja'afar Hospital previously diagnosed with having

Fig 1–Location of study area, Seremban, Malaysia.
(Source: Adapted from Shamsuddin and Yaakup, 2007; Rasidi, 2011).

dengue infection. Tuanku Ja'afar Hospital is the government hospital which was formerly known as Seremban General Hospital. An interview was conducted to obtain information from each household about socio-demographics, duration of dengue infection, use of medical services, treatment costs, other treatment related costs, indirect costs of the illness, and lost days of work or school. The households chosen were randomly selected from those with a history of having a member with

dengue infection. The patients or their legal guardians (if the patient was a child) were contacted and asked to participate in a face-to-face interview. Each participant was interviewed once, either at home or at work. The survey was conducted from November 2010 to February 2011. The costs were recorded in Malaysian Ringgit (MYR) and then converted to US Dollars (USD) following the exchange rate on December 1, 2010 (MYR 1 = USD0.317) (Bank Negara Malaysia, 2010).

Data analysis

The total cost for a dengue patient was estimated by summing direct medical costs, direct non-medical costs, and indirect costs borne by the household during the entire illness. Direct medical costs were calculated taking into consideration the direct cash expenses for treatment of the patient which included the doctor's fee, laboratory tests, diagnosis, inpatient or outpatient care, procedures and medication. Direct non-medical costs included cash payments for food, lodging, transport charges to and from health care facilities or drug stores and miscellaneous expenses associated with seeking and obtaining medical care as well as household members visiting patients in the hospital. Calculation of indirect costs consisted of assigning a monetary value to three major components: 1) days of school lost, 2) days of work lost by the patient, and 3) days of work lost by household members caring for the patient during their illness. To quantify the cost of school days lost due to illness, this study made the conservative assumption that it was equal to the cost per day of primary schooling (Kongsin *et al*, 2010). This assumption was based on the fact that primary education is publicly funded in all countries and the economic value of a day of school must be at least equal to the cost of providing a day of

public primary school. Based on a previous study on the burden of dengue infection (Suaya *et al*, 2009), the cost per day for primary education in Malaysia was estimated to be MYR 15.93 (USD 5.05) in 2010. Therefore, the cost for school days lost was calculated as the product of the daily cost times the number of school days lost. This study used the higher of the daily wage reported by the respondent or Malaysia's minimum daily wage to value a day of work lost to the patient or caregiver. In Malaysia, the current minimum wage is MYR700 per month for a private security guard (Berita National Malaysia, 2011; Anis, 2011). However, the National Wages Consultative Council (2011) recommended a benchmark wage of MYR700 per month for all sectors. This value was used in our study to estimate the minimum daily wage. The total cost for work days lost was calculated as a product of the average daily wage lost times the number of work days lost. Means, standard deviations, percentages, maximums, minimums, and ratios were calculated where appropriate.

Ethical considerations

This study was approved the Medical Research Ethics Committee (MREC), Ministry of Health, Malaysia (MREC Code No. NMRR-11-730-9099). The study did not provide any financial or other incentives to the respondents or their families to participate in the survey.

RESULTS

Socio-demographic profile of the study patients

A total of 120 patients with confirmed dengue infection were included in the study. The number of hospitalized dengue cases (94) was higher than the number of cases treated as an outpatient (26).

Table 1
Socio-demographic characteristics of study patients ($N = 120$).

Characteristics	No. (%)
Gender	
Male	79 (65.8)
Female	41 (34.2)
Marital status	
Single	53 (44)
Married	67 (56)
Residence	
Urban	118 (98)
Rural	2 (2)
Ethnicity	
Malay	60 (50)
Chinese	35 (29)
Indian	25 (21)
Education level	
No formal schooling	7 (5.8)
Primary Education (6 years of schooling)	12 (10)
Lower Secondary Education (3 years of schooling)	38 (31.7)
Upper Secondary Education (2 years of schooling)	42 (35)
Pre-university Senior Secondary Education (2 years of schooling)	2 (1.7)
Certificate/ Diploma (2/3 years of study)	17 (14.2)
Graduate (3 years of study)	2 (1.7)

Table 1 shows the socio-demographic characteristics of study patients. Sixty-five point eight percent of participants were male and 56% were married. Ninety-eight percent of households participating in the study were in urban areas. Significantly more Malays (50%) than Indians (21%) had dengue infection. The comparatively higher incidence of dengue in Malays is probably due to predominance of this ethnic group among the total population of the District. Fifty-two percent of the populations in the District are Malays whereas 16% are Indians (Department of Statistics, Malaysia, 2011). A small portion of participants (5.8%) has no formal education. The majority of the participants (78%) had completed primary and secondary school. A small minority of participants (1.7%) completed university education.

Table 2 shows the distribution of the participants by occupation. Fifty-one point seven percent of the participants worked. Of those working, 31.7% worked in the private sector, 10.8% worked in the public sector and 9.2% were self-employed. Twenty-five point eight percent of those who did not work were school students and 22.4% were retired, housewives, unemployed or pre-school children. The greater percentage of dengue infection among the private sector employees is probably due to their predominance in the total population of the district. Private sector contributes to higher percentage (52%) of total employment in the district, followed by public sector (28.3%) and self-employment (19.3%) (Department of Statistics, Malaysia, 2011). This can also be attributed to an increasing tendency

Table 2
Distribution of the participants by occupation (N = 120).

Occupation	No. (%)
Working	
Public sector employee	13 (10.8)
Private sector employee	38 (31.7)
Self-employed	11 (9.2)
Not working	
Student	31 (25.8)
Retired	4 (3.3)
Housewife	10 (8.3)
Unemployed	7 (5.8)
Others (pre-school child)	6 (5.0)
Total	120 (100%)

Table 3
Health care services used by patients.

Health care data	Mean	SD
Days hospitalized	5.63	1.23
Number of ambulatory visits	3.12	0.65
Days ill	9.69	1.89

SD, Standard deviation.

of people moving from villages to urban areas for economic purposes.

Health care services used by patients

Table 3 shows the usage of health care services by the patients. A dengue infection patient was hospitalized for, on average, 5.63 days while the patient visited 3.12 times the outpatient department/ward of the hospital before and after being hospitalized. The average length of illness was 9.69 days.

Patient and caregiver days lost to regular activity

Table 4 shows patient and caregiver days lost due to dengue infection. The disease affected school attendance as well as other regular activities of the patient and household members. The school-going patients lost an average of 6.25 days of school while the patients who were working at the time of illness lost 7.66 days of work. In addition, the other household members (eg, caregivers) lost 4.82 days of work for caring the patient. Thus, an episode of dengue resulted in 18.73 days of school and work lost by the household.

Direct expenses

Table 5 shows the direct expenses per dengue case. The total direct expenses were estimated to be USD37.26. Twenty-four point one percent of the total direct expenses (USD8.98) was for medical care, which included expenses for physician consultation, diagnostic testing, and medication. Non-medical direct expenses, such as the cost of transportation, food

Table 4
Patient and caregiver days lost to regular activity.

Patient and caregiver days lost	Mean	SD
Days of school lost	6.25	1.58
Days of work lost (patient)	7.66	1.55
Days of work lost (caregiver)	4.82	1.37
Total days lost	18.73	1.42

SD, Standard deviation.

Table 5
Direct expenses per dengue case.

Item	Cost in USD	SD	Range (USD)
Cost for medical care	8.98	40.59	0.38-80.14
Transportation cost (patient)	13.11	14.21	6.36-25.44
Cost of food, drinks, etc (patient and caregiver)	9.15	8.43	3.18-15.90
Cost of family members visiting patients	6.02	6.15	3.18-11.13
Total of average cost of treatment per case	37.26	9.16	6.02-13.11

[a]SD, Standard deviation.

Table 6
Indirect expenses per case of dengue.

Item	Cost in USD	SD	Range (USD)
Cost of school days lost	31.56	25.11	20.20-40.40
Cost of work days lost by patient	178.42	218.5	68.90-333.90
Cost of work days lost by caregiver	117.92	164.6	33.92-238.50
Total indirect expenses per episode	327.90	232.1	31.56-178.42

SD, Standard deviation.

and drinks constituted nearly 76% of the total direct expenses. The largest single direct expense was the cost of transportation followed by food and drinks (USD9.15) for patients and caregivers. The household experienced a sizeable expense for family members to visit hospitalized patients (USD6.02).

Indirect expenses

Table 6 shows the indirect expenses per dengue case. The total indirect expense per dengue case was USD327.90. Fifty-four percent of indirect expenses were due to adults missing work and 9.62% were due to children missing school. The average loss of income per household for a case of dengue infection was estimated to be USD117.92; nearly 36% of the total indirect expenses.

Total expenses

Fig 2 shows the total expenses, both direct and indirect per case of dengue infection; this is the amount borne by the household. The total expense per dengue case for the household was USD365.16, comprised of USD8.98 for direct medi-
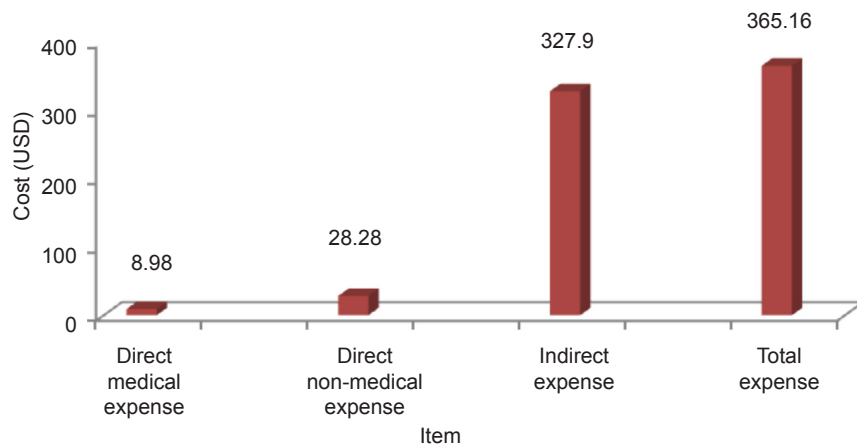
Fig 2–Total average expense per dengue case to household.

cal expenses, USD28.28 for direct non-medical expenses and USD327.90 for indirect expenses. The indirect expenses comprised the largest proportion (89.8%) of the total expenses per dengue case. The direct expense constituted only 10.2% of the total expenses per dengue case.

DISCUSSION

We determined the cost per dengue case per household in Seremban District, Malaysia. This included direct and indirect expenses and time lost. The average length of illness was 9.69 days, which is similar to other studies (Clark *et al*, 2005; Huy *et al*, 2009; Suaya *et al*, 2009; Kongsin *et al*, 2010; Suaya *et al*, 2010). Dengue illness affects not only school attendance and parental work but also the activities of other household members who provide care for the patient. A single episode of dengue resulted in 18.7 days of school and work lost by the household. Other studies of dengue have reported similar results (Armien *et al*, 2008; Suaya *et al*, 2009; Kongsin *et al*, 2010; Suaya *et al*, 2010).

The total expenses to the household from a case of dengue infection in our study were higher than a previous study from Malaysia (USD154.50) (Suaya *et al*, 2009). One reason for this is many of the households surveyed in our study first went to a private clinic, which is expensive, prior to going to a government hospital and being diagnosed with and treated for dengue infection.

In a study from India at a private hospital, the total expenses per case of dengue infection were higher than ours (USD585.57) (Bhavsar *et al*, 2010). In Thailand, Kongsin *et al* (2010) estimated the cost to be USD155.00 in 2005. Suaya *et al* (2010) reported the household cost per child with dengue fever to be USD116.00 in Cambodia in 2005. In Panama, Armien *et al* (2008) reported the cost to be USD332.00 in 2005. In Vietnam, Tam *et al* (2012) reported the cost to be USD168.00 in 2007. The differences in expenses may be due to socio-economic differences by country and even within a country. A richer country, like Panama, would be expected to have greater expenses while a poorer country, like Cambodia, would be expected to have lower expenses (Harving and Ronsholt, 2007).

A limitation of this study was the only patients included were those registered at the public hospital in Seremban District. The study did not include patients treated at private hospitals/clinics or other health care facilities, such as traditional healers and herbalists. The expenses per dengue case may have varied widely from one health facility to another, especially

between public and private hospitals. Seeking treatment at a private hospital is more expensive than a public hospital in Malaysia. The estimated cost per dengue case in this study is conservative. Dengue illnesses can cause stress due to illness and grief due to death. These intangible costs can be substantial. We did not address these intangible costs in this study. However, this is the most comprehensive study of household expenses due to dengue infection in Malaysia.

In summary, this study estimated household cost due to dengue infection in Seremban, Malaysia. We estimated both the direct and indirect costs. The average total estimated household cost per dengue illness was USD365.16, the estimated direct cost was USD37.26 (10% of the total cost) and the estimated indirect cost was USD327.90. These results can inform policy-makers about economic impact of this disease in order to guide and prioritize control strategies and funding.

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