THE COST OF DENGUE HEMORRHAGIC FEVER IN THAILAND

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Abstract. The economic burden of DHF patients and of the Thai government in providing treatment and prevention and control of dengue hemorrhagic fever were assessed. Patient burden was reported by caretakers who stayed with the patients when they were admitted to three hospitals: Children's Hospital in Bangkok; Suphan Buri Provincial Hospital and Don Chedi Community Hospital, Don Chedi District in Suphan Buri Province. The hospital costs - medicine and laboratory costs - were collected from the treatment forms and the routine service cost was estimated by the staff of the hospitals. Cost of prevention and control were compiled from the budget report of Departments of the Ministry of Public Health and the Ministry of Interior.

Based on 184 DHF patients admitted at the three hospitals, the direct patient costs - treatment cost and the costs of travel, food and lodging - was 66.99 US$ and 61.02 US$ per patient for one episode of DHF in Bangkok and Suphan Buri, respectively. The total patient costs - direct patient costs and opportunity costs were 118.29 US$ for a child patient and 161.49 US$ for an adult patient in Bangkok, 102.82 US$ for a child patient and 138.02 US$ for an adult patient in Suphan Buri. The net hospital cost in providing treatment for each DHF patient was 54.6 US$ and 38.65 US$ in Bangkok and Suphan Buri, respectively. The total cost of prevention and control of DHF in Thailand from government agencies in 1994 was 4.8724 million US$. Based on these findings, the whole expenditure of Thailand for DHF in 1994, would be at least 12.596 million US$, of which 54.8% was from the government budget, the rest, 45.2%, was the expenses paid by 51,688 patients and their families. The study concluded that in recording the economic loss of DHF both the expenditures of the government and also the patient costs - direct and indirect - should be taken into account.

INTRODUCTION

During recent decades, dengue fever has emerged as a major health problem in tropical countries. Dengue fever often occurs in epidemics in which the severe form, dengue hemorrhagic fever (DHF) can be fatal. Annually, there are approximately 20 million infections globally and thousands of deaths. DHF is one of the leading causes of hospitalization of children in Southeast Asia (Lederberg *et al*, 1992; WHO, 1996). Beside the high morbidity and mortality, the other side of the problem concerning the social and economic impact of DHF is equally important, if not more so. Unfortunately this problem, like that of other diseases has been neglected. Health authorities usually are happy once the mortality of a disease has decreased and then the budget for prevention and control is reduced until high morbidity and mortality rates were apparent again. It is the intention of this study to elucidate the economic burden of DHF using evidence in Thailand as the example, hoping that the result will stimulate effort by health personnel to evaluate other impacts of a disease on the life of the people besides its physical threat.

The first epidemic of DHF in Thailand occurred in Bangkok, then it spread to other large cities. Within two decades, DHF spread all over the country. The highest number of cases so far recorded was in 1987 when the morbidity rate reached 325 per 100,000 population (Ungchusak and Kunasol, 1988). In 1994, 51,688 cases of DHF were reported with 140 deaths (MOPH, 1995). Only two studies have been conducted on costs of treatment and both were in provincial hospitals in the northeast of Thailand. The first study, carried out at Khon Kaen Provincial Hospital, showed that for each admitted case of DHF, the average medical expenses was 125 US$ and other expenses, such as transportation averaged 25 US$ (Maturassaps, 1981). The other study revealed that among 577 DHF patients admitted to Maha Sarakham Provincial Hospital, the patient cost was 23.28 US$ while the hospital expenditure per patient was 44 US$ (Swasdivorn *et al*, 1991). The two studies were conducted in provincial hospitals where the treatment cost might not

represent Thailand as a whole because DHF is now epidemic in both urban and rural settings. The present study, in addition to investigating community settings, has investigated the costs of prevention and control of DHF from government agencies and extrapolated all the costs related to DHF to the country scale so that the real economic impact of this disease could be more easily understood.

MATERIALS AND METHODS

The information in this study was collected from three different sources: the patients, the hospitals and the government agencies carrying out prevention and control activities.

Patients

Since most of the DHF cases were children, the information from patients was collected by interviewing the caretakers who were attending the patients in the hospitals. These caretakers were either the parents or relatives of the patients. The study was carried out in three hospitals. The Children's Hospital was chosen as the study site for Bangkok. Suphan Buri Provincial Hospital and Don Chedi Community Hospital were selected to represent the provincial and district hospital levels, respectively. All patients clinically diagnosed as DHF who were admitted in the three hospitals during July and August 1994 were included in this study. Information on the socio-demographic characteristics, the expenditures of patients and caretakers, and the opportunity costs were collected by interviewing them at the hospitals with a closed- and open-ended questionnaire. This questionnaire was developed and tested prior to the interview.

Hospitals

The hospital costs in providing treatment for each DHF patient comprised mainly the expenses of the Out Patient Department (OPD) and the In Patient Department (IPD). Due to the fact that the OPD expenditure of any hospital would usually cover all kinds of patients and medical personnel on duty had to look after all of them, and since the number of DHF patients in relation to the overall OPD cases was very small, an accurate estimation of OPD cost of DHF alone was not possible, so the study had to omit OPD costs from total hospital costs. In IPD, the DHF patients usually were put in a separate ward so the cost of nursing and other care of the DHF patients during the hospitalization period could be estimated. The cost of electricity, water supply, space utilization and salaries of medical personnel in taking care of DHF patients, however, could not be distinguished from the overall hospital expenditure during this study. The IPD cost of medicine and laboratory were collected from the treatment forms and estimated by the administrative staff of each particular hospital.

Prevention and control program

Prevention and control costs were collected from three sources. The Ministry of Public Health (MOPH) via the Department of Communicable Diseases Control (CDC), the Ministry of Interior (MOI) via the Municipality Administrative Committee of the City, the Sanitary Committee of the District, and Bangkok Metropolitan Administration (BMA) via their Vector Control Unit. Normally, the budget for disease control of MOPH is allocated to the Office of the Permanent Secretary of State for Public Health, thence to CDC, which then allocates it to the Division of Vector Borne Diseases and to 12 CDC Regional Centers. Most of this allocation was used for procurement of insecticides and travel expenses of the local health officers. There is another budget under the Office of the Permanent Secretary which is allocated for the activities of public relations and health education of infectious diseases, but unfortunately details of these were not available at the time of the study

Several factors made it impossible to get all costs of the prevention and vector control activities in Bangkok and Suphan Buri Province. First, some expenditures were not the actual costs since they were allocated for general vector control activities which made it difficult to separate only the DHF portion. Second, the labor costs of health manpower in governmental institutions were budgeted *in toto* regardless the kinds of job being done. The study tried to estimate these costs as closely as possible by using time-sharing as the base of calculation. Third, there were other sources of non-governmental funds which contributed to DHF work, *eg* from research, hospital income, non-governmental organizations and the community. These

factors made the total amount for prevention and control uncertain and varied from year to year and province to province. With these constraints, the costs of prevention and control reported herewith should be considered as minimal. Certainly there were other fixed provider costs (salaries of administrators, wages, management, transportation, maintenance, etc) which could not be extracted at the time of the study.

RESULTS

Socio-demographic characteristics of DHF patients

There were 184 patients in this study of which 72 cases were from Children's Hospital, 99 cases from Suphan Buri Provincial Hospital and 13 cases from Don Chedi Community Hospital. Since the number of patients from Don Chedi Hospital was small and there was not much difference in terms of socio-demographic characteristics from those of the Provincial Hospital, the patients from these two hospitals were grouped together as Suphan Buri patients.

When patients in Bangkok and Suphan Buri were compared, no significant difference in age, sex and education was observed, except for three patients in Suphan Buri who were over 14 years of age. A difference, however, was observed in residential area and income of the family (Table 1).

Table 1

Socio-demographic characteristics of DHF patients.

	Bangkok (N = 72) %	Suphan Buri (N = 112) %
Age (Years)		
0-4	23.6	11.6
5-9	44.5	50.0
10-14	31.9	35.7
> 14	-	2.7
Gender		
Male	48.6	54.5
Female	51.4	45.5
Education		
Have not attended school	15.3	8.0
Kindergarten	18.0	26.8
Primary school	54.2	55.4
Secondary school	12.5	9.8
Residential area		
Urban	97.2	23.2
Rural	2.8	76.8
Family income (Med = 280US$/m)		
Median and below	30.6	67.0
Above	69.4	33.0

Patient costs

The patient costs comprised two main expenditures - the direct patient costs and the opportunity costs.

Direct patient costs: The direct patient costs comprised the treatment cost and the costs of travel, food and lodging paid by the patients or their relatives while taking care of the patients. The treatment costs included pre-hospitalization and hospitalization costs (Table 2). The average treatment costs in Bangkok (50.08 US$) were higher than in Suphan Buri (40.31 US$); the higher cost was seen in both pre-hospitalization costs and hospitalization costs. However, the travel costs and the costs of food and lodging spent in Suphan Buri were higher than in Bangkok. In all, the average direct patient costs in Bangkok were 66.99 US$ which was a little higher than the 61.02 US$ in Suphan Buri.

Table 3

The patient costs of DHF.

Cost	Bangkok US$	Suphan Buri US$
Direct		
Pre-hospitalization cost/patient	10.36	8.80
Hospitalization cost/patient	39.72	31.51
Treatment cost/patient	50.08	40.31
Travel cost/patient	8.94	10.21
Cost of food and lodging/patient	7.97	10.50
The direct patient cost/patient	66.99	61.02
Indirect		
Opportunity cost of adult patient	43.20	35.20
Opportunity cost of the caretaker	51.30	41.80
Total cost of adult patient	**161.49**	**138.02**
Total cost of child patient	**118.29**	**102.82**

Opportunity costs: In this study, the opportunity

costs occur not only for adult patients who were absent from work, but also for the caretakers who were absent from their work to take care of the patients. There were two groups of caretakers in this study: the main caretaker and the assistant caretaker. The main caretakers usually were the parents who were responsible for all expenses and decided where the treatment should be sought. The assistant caretakers were relatives who helped the parents either in doing the house work or looking after the patient for a short period of time. The average duration of illness of a patient and the average absence from work of a main caretaker and an assistant were 8, 6 and 3.5 days, respectively.

Taking the minimum daily wage at the time of study as 5.4 US$ for Bangkok and 4.4 US$ for Suphan Buri, the average opportunity costs due to absence from work in the two respective areas would be 43.2 and 35.2 US$ per adult patient. For the caretakers, the average opportunity costs would be 32.4 and 26.4 US$ per main caretaker and 18.9 and 15.4 US$ per assistant in Bangkok and Suphan Buri, respectively. Consequently, the total patient costs which included direct patient costs and opportunity costs on average were 118.29 and 102.82 US$ for a child patient and 161.49 and 138.02 US$ for an adult patient in Bangkok and Suphan Buri, respectively (Table 3).

Mortality costs

In this study, fortunately no death was encountered. However, it was reported that 140 persons died from DHF in Thailand in 1994. In addition to the psychological impact on the family due to the death, mortality costs - funeral cost and the potential income loss - occurred in such cases. From interview, it was estimated that the funeral cost was 395 US$ for a child death and 648 US$ for an adult death. Based on Gross National Product in 1994, the potential life-time income loss was 120,000 US$ per person. Therefore, the mortality cost would be 120,397 US$ for a child and 120,648 US$ for an adult.

Provider costs

Hospital expenditure: The study revealed that the hospitals in Bangkok and Suphan Buri spent 70.6 US$ and 56.95 US$ for each DHF patient, respectively (Table 4). These expenditures were the expenses outlaid on drugs, laboratory tests and routine service costs. However, in return, the hospitals had already charged the patient for drugs and laboratory tests, so that the net hospital expenditure that should be accounted for was only the routine service costs. These costs were found to be 54.6 and 38.65 US$ in Bangkok and in Suphan Buri, respectively (Table 4).

Morbidity cost. The total morbidity cost which consisted of direct patient cost, opportunity cost and the hospital expenditure, would be 172.89 and

Table 2

The direct patient costs in seeking treatment of DHF.

Cost	Bangkok (N = 71) US$	Suphan Buri (N = 93) US$
Pre-hospitalization cost		
Average/patient	10.36	8.80
Range	0-63.2	0-97.0
Hospitalization cost		
Average/patient	39.72	31.51
Range	3.2-22.36	4-127.12
Treatment cost		
Average/patient	50.08	40.31
Range	6-240.4	7.56-130.52
Travel cost		
Average/patient	8.94	10.21
Range	0-29.28	0-50.4
Cost of food and lodging		
Average/patient	7.97	10.50
Range	0-36	1.2-86.0
The direct patient cost		
Average/patient	66.99	61.02
Range	16.72-275.00	17.32-220.44

Table 4

Hospital expenditure of DHF patients.

Expenditure	Children's Hospital US$	Suphan Buri Hospitals US$
Drug cost	10.90	12.80
Laboratory cost	5.10	5.50
Routine service cost	54.60	38.65
Total	70.60	56.95

141.47 US$ for a child and 216.09 and 176.67 US$ for an adult in Bangkok and Suphan Buri, respectively.

Prevention and vector control cost: In 1994, the Division of Vector Borne Diseases, CDC allocated 1.869 million US$ on materials, supplies and subsidies to all provincial health offices for the activities related to control of DHF. The BMA allocated 0.112 million US$ for adulticides and larvicides in the Bangkok area (Table 5).

In Suphan Buri, the Municipality Committee allocated ≈ 0.01695 million US$ for DHF control activities and on average the Sanitary Administration Office of each district allocated 0.0012 million US$, making a total of 0.0216 million US$ for 18 districts in the province. Using the costs for prevention and control at Suphan Buri as the average cost for a province in Thailand, the total costs of prevention and control of Bangkok and the other 75 provinces would be 4.8724 million US$ (Table 5). This cost should be taken as minimal because there were some other expenditures from the Office of Permanent Secretary, MOPH and other divisions in CDC which could not be obtained during this study.

Extrapolation of the cost for DHF in Thailand in 1994

In 1994 in Thailand as a whole, 51,688 cases were reported with 140 deaths. Using the costs from this study as a basis, (*ie* the patient costs at the Children's Hospital for all DHF patients in Bangkok and the patients costs in Suphan Buri for the DHF patients in other provinces) it was estimated that the total patient costs would be 5.6364 million US$, the funeral costs would be 0.0596 million US$, making the total cost to the patients 5.696 million US$ without considering the potential life-time income loss of those who were dead (Table 6).

On the provider side, the Thai government spent 2.0276 million US$ to provide hospital care for DHF patients and another 4.8724 million US$ for the prevention and control program. In all, the total cost due to DHF in Thailand in 1994 was about 12.596 million US$ of which 45.2% was the expense paid by the patients and their families, the remaining 54.8% came from the government budget (Table 6).

DISCUSSION

The study of the cost of DHF in Thailand was done in a short period of time with limited resources, so could not cover all information. Nevertheless, it has shown the other aspect of the burden of infectious disease. Evidence from this study showed that DHF also has an impact on people's way of life. While DHF attacks children physically, it also disturbs the way of life and the economic situation of the their parents and relatives. This impact, in economic terms, can be as much as 5.696 million US$ or almost half of the total cost of DHF in the country. When the patient cost was considered at family level, it was revealed that the average expense for a DHF patient would be about 22-23% of the average monthly family income. If the opportunity costs of the caretakers and assistants are taken into consideration, the total patient cost would represent 37-57% of the monthly family income. The expenditure is a burden to the family since it would take away about half of their earning. This loss would be more severe in families whose income is normally at survival level. It would be worse if DHF continues to attack other

Table 5

The total costs of prevention and control of DHF in Thailand, 1994.

	million US$
1. Department of Communicable Disease Control, Ministry of Public Health	1.8690
2. Division of Disease Control, Bangkok Metropolitan Administration	0.1120
3. All 75 provinces (0.038552 US$/province × 75 provinces)	2.8914
Total	4.8724

Table 6
Extrapolation of the cost of DHF in Thailand in 1994.

	Bangkok		Province
Total number of patients (case)	1,870		49,818
No. of patients under 15 yr	1,483		41,968
No. of patients over 14 yr	387		7,850
Total number of deaths (case)	1		139
No. of deaths under 15 yr	1		122
No. of deaths over 14 yr	-		17
Patient cost (million US$)			
Total patient cost (under 15 yr)	0.1754		4.3151
Total patient cost (over 14 yr)	0.0625		1.0834
Total funeral cost (under 15 yr)	0.0004		0.0482
Total funeral cost (over 14 yr)	-		0.0110
Total cost to the patients	0.2383		5.4577
Overall cost to the patients		**5.6960**	
Provider cost (million US$)			
Total hospitalization cost	0.1021		1.9255
Overall hospitalization cost		**2.0276**	
Total prevention and control cost		**4.8724**	
Total cost to the provider		**6.9000**	
Total costs of DHF (million US$)		**12.5960**	

Note: The potential life-time income loss of the death was not included in the patient costs.

members of the family. It was not uncommon in this study to find a child of the same family had been suffering with DHF prior to the present case.

The provider, in this case the Thai government, has to allocate the budget for prevention and control and for the hospital expenditure every year. Though it had no opportunity to collect all information on the actual expenditure of all government health agencies, this study has shown that each year at least a sum of nearly 7 million US$ has to be allocated for DHF. The majority of this expenditure is on chemicals as insecticides. This is going to be an endless expenditure, if the mosquito control program has not been taken into serious consideration.

By extrapolation of the DHF costs in 1994, it can be seen that the patients and families had to bear almost half of the total cost of DHF management. This amount of 5.696 million US$ a year represented the patients' expenditure in an area of average DHF epidemicity. If the epidemic level is higher the cost would definitely be more. This cost was also shown to be related to the treatment seeking behavior of the patients. The longer they delayed going for hospitalization, the more they had to pay (Okanurak *et al*, 1997)

The best way to lessen the burden of the country, both on its people and on its governmental expenditures is to prevent the children from being infected by dengue virus. To do this, it needs an effective prevention and control strategy and early diagnosis to shorten the illness duration and hospitalization time. However, one has to keep in mind that the key to success is dependent on community awareness and participation. To raise community awareness and eventually get their participation is a tedious and continuous work. One approach is to demonstrate to the public that DHF does not only take away several million US$ from the tax money annually, but it does also draw more or less an equivalent sum from the people's own money. In addition there is a risk of childhood death.

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