

# The economic impact of dengue hemorrhagic fever on family level in Southern Vietnam

Mette Lønstrup Harving, MD, &  
Frederikke Falkencrone Rønsholt, medical student

University of Copenhagen and Children's Hospital No. 1, Ho Chi Minh City, Vietnam

Correspondence: Frederikke Falkencrone Rønsholt, Rebekkevvej 27 st. th., 2900 Hellerup, Denmark.

E-mail: frederikkefr@gmail.com

Dan Med Bull 2007;54:170-2

## ABSTRACT

Dengue fever is a viral infection transmitted by mosquitoes (*Aedes Aegypti*). WHO estimates that 40% of the world's population live in areas endemic for dengue fever, and that there are approximately 50 million cases of dengue infection worldwide every year.

This study aims to measure the economic consequences of dengue hemorrhagic fever in Southern Vietnam on family level. Estimating the economic impact of dengue fever/dengue hemorrhagic fever is important in order to prioritize resources for research, prevention, and control. So far no studies from Vietnam concerning this subject have been published.

The study is based on standardized interviews. The study includes 175 children at the age 0-15 years, hospitalized in Children's Hospital No 1 in Ho Chi Minh City during a 10-week period in the fall of 2005. The children's parents/caretakers were interviewed on expenses related to the child's disease.

The study shows that the average family cost of treating one child is approximately 61 USD including direct and indirect costs. On average, the largest expenses were those related to the initial visit at a local general practitioner, the hospital bill from Children's Hospital No1 and lost income for the parents.

Dengue hemorrhagic fever is a large expense for a family and can rightly be considered as a substantial socio-economic burden in Southern Vietnam. Larger studies are needed for a more accurate estimate of the extent of the expenses related to both dengue fever and dengue hemorrhagic fever.

## INTRODUCTION

Dengue fever (DF) is a viral infection transmitted by mosquitoes (*Aedes Aegypti*). The infection can manifest itself as flu-like DF or as hemorrhagic dengue fever (DHF) with plasma leakage and the risk of shock and death. DHF is divided into four grades according to clinical symptoms and severity, grade I being the mildest form and grade IV the most severe. Grade III and IV constitute the dengue shock syndrome (DSS) with incipient or profound shock.

- Grade I: Fever, non-specific symptoms, positive tourniquet test\* and/or easy bruising.
- Grade II: Spontaneous bleeding in addition to the manifestations of grade I.
- Grade III: Circulatory failure manifested by rapid, weak pulse, and narrowing pulse pressure or hypotension.
- Grade IV: Profound shock with undetectable blood pressure and pulse.

There is no specific treatment for DF. The patients are treated with paracetamol, oral rehydration and IV fluids according to WHO's guidelines [1].

WHO estimates that DHF is endemic in over 100 countries and that 40% of the world's population is living in risk areas [2]. The past years have shown an expansion of geographical distribution of

## Abbreviations

|       |   |
|-------|---|
| DF    | Dengue fever                                  |
| DHF   | Hemorrhagic dengue fever                      |
| DSS   | Dengue shock syndrome                         |
| ELISA | Enzyme-Linked ImmunoSorbent Assay             |
| IV    | Intravenous                                   |
| OSVAL | Mandatory, independent, free of choice thesis |
| USD   | American dollars                              |
| WHO   | World Health Organization                     |
| GNI   | Gross national income                         |

both the virus and the mosquito vectors resulting in an increased frequency of epidemics, thus making ground for hyperendemic areas [3]. DHF is now among the commonest causes of hospitalization of children in South-East Asia [4].

The study aimed at measuring the economic consequences of having a member of ones family admitted with DHF. This is part of the quantification of the disease burden, a parameter in the distribution of funds for health care and research in order to target health interventions and to provide a comparable measure for intervention [5].

So far no studies from Vietnam concerning this subject have been published.

The study has been made as an OSVAL II thesis at the University of Copenhagen.

## METHODS

### METHOD

The study is based on standardized interviews of the patients' parents/caretakers (appendix 1).

The questionnaire consists of two parts, a data part (items 1-9) and an interview part (items 10-18).

The data part deals with age, gender, address, grade of disease, ELISA confirmation, number of admission days (spent in semi-emergency room and normal room), and the hospital bill.

The interview part is a standardized interview chart and deals with the family cost of the child's illness besides the hospital bill from the dengue hemorrhagic department.

The questionnaire includes both direct (hospital bills, doctor visits, additional laboratory tests, and medication) and indirect costs (lost income, transportation, food, and other expenses due to inconvenience).

The families were also asked about the means of funding the direct costs (whether it was their own funding, insurance, or governmental/hospital contribution).

## POPULATION

The population consisted of children admitted to the Dengue Hemorrhagic Fever Department in Children's Hospital No 1, Ho Chi Minh City, with the diagnosis DHF in the period from August 25, 2005 to November 3, 2005. The patients were not randomized for the study, but were chosen at random without previous knowledge of the economical status of the family.

The inclusion criteria were:

- age: 0-15 years
- clinically diagnosed as having DHF according to guidelines [1]
- diagnosis confirmed by ELISA test

The exclusion criteria were:

- insufficient data obtained in the interview
- other chronic diseases

The patients were examined and diagnosed by doctors from the Dengue Hemorrhagic Fever Department. The patients were referred to the department from the hospital's outpatient ward, private doctors, or rural hospitals thus making the population a mixed group of

residents of Ho Chi Minh City and provinces surrounding the city.

Personal data, grade of disease, infusion status, number of days admitted, and hospital bill were obtained from the patients' charts

The parents/caretakers of the children included in the study were interviewed bedside on the day of discharge by a Vietnamese speaking doctor from the department and either of the authors.

The population was divided into groups according to grade of disease (grade I-IV) and type of treatment (patients not requiring infusions, patients requiring only crystalloid infusions, patients requiring colloid infusions). **Table 1** shows the composition of the population.

## ETHICS

The study was approved by The Scientific and Ethical Committee of Children's Hospital No 1. No written, informed, consent was obtained in the study. The participants gave oral consent. Participation did not involve any expenses or inconveniences for the family.

## RESULTS

The average cost for a family with a child having DHF is 61.36 USD, of which 32.73 USD are direct costs and 28.73 USD are indirect costs. **Table 2** shows the average expenses divided in direct and indirect expenses, **Table 3** and **Table 4** show the expenses according to grade of disease and type of treatment.

**Table 1.** Population.

|                  | N   | %  |
|------------------|-----|----|
| Age, years       |     |    |
| <1               | 5   | 3  |
| 1-<5             | 31  | 18 |
| 5-<10            | 66  | 38 |
| 10-15            | 73  | 42 |
| Gender           |     |    |
| Male             | 94  | 54 |
| Female           | 81  | 46 |
| Address          |     |    |
| HCMC             | 108 | 62 |
| Province         | 67  | 38 |
| Grade of disease |     |    |
| I                | 7   | 4  |
| II               | 123 | 70 |
| III              | 39  | 22 |
| IV               | 6   | 3  |
| Treatment        |     |    |
| No infusions     | 82  | 47 |
| Crystalloid      | 60  | 34 |
| Colloid          | 33  | 19 |

**Table 2.** Average expenses divided in direct and indirect expenses.

| Costs  | Average amount in USD (range in USD) |
|--|--------------------------------------|
| <i>Direct costs</i>  |                                      |
| Hospital bill  | 16.65 (2.31-125.75)                  |
| Doctor visits/ admission to local hospital and medication* | 12.46 (0-158.23)                     |
| Laboratory tests not included in hospital bill             | 3.62 (0-101.27)                      |
| Total  | 32.73 (5.34-198.29)                  |
| <i>Indirect costs</i>                                      |                                      |
| Loss of income   | 12.78 (0-126.58)                     |
| Transport  | 6.56 (0-75.95)                       |
| Food   | 9.29 (0-63.29)                       |
| Total  | 28.63 (0-177.22)                     |
| Total direct and indirect costs                            | 61.36 (5.34-280.57)                  |

\*) Medication is most often given by a doctor and included in the bill from the doctor. Most people can't differentiate what amount is spent on medications and what amount is for the doctor's visit itself.

**Table 3.** Average expenses according to grade of disease. An F-test (variance-ratio test) on the total expense values gives an F-value of 14.85 (P<0.0001). The expenses increase significantly with the severity of the disease.

| Grade of disease | N   | Direct cost (USD) | Indirect cost (USD) | Total cost (USD) |
|------------------|-----|-------------------|---------------------|------------------|
| I                | 7   | 20.17             | 19.56               | 39.72            |
| II               | 123 | 23.62             | 26.20               | 49.82            |
| III              | 39  | 55.78             | 35.78               | 91.55            |
| IV               | 6   | 84.29             | 42.51               | 126.80           |

**Table 4.** Average expenses according to type of treatment. An F-test (variance-ratio test) on the total cost values gives an F-value of 41.12 (P<0.0001). The expenses increase significantly when starting or intensifying IV fluid treatment.

| Treatment    | N  | Direct cost (USD) | Indirect costs (USD) | Total cost (USD) |
|--------------|----|-------------------|----------------------|------------------|
| No infusions | 82 | 17.76             | 21.49                | 39.25            |
| Crystalloid  | 60 | 30.45             | 32.46                | 62.90            |
| Colloid      | 33 | 74.05             | 39.42                | 113.43           |

## DISCUSSION

The average family cost of treating one child with DHF is approximately 61 USD including direct and indirect costs. Considering that the gross national income (GNI) per capita in Vietnam in 2005 was 620 USD [6], 61 USD is a large figure and more than an average monthly salary.

Calculating the cost does not take into account that children under 6 years of age who are citizens of Ho Chi Minh City (n=17) are paid for by the government, and it does not take into account that some patients (n=23) have insurance to cover their direct costs. Nor does it consider that more than one child in a family can get DHF. These factors cause an underestimation of the family cost.

The distribution of cost is shown in Table 2. It shows that the largest average single expense is the initial doctor visit. This expense is often larger than the entire hospital stay at Children's Hospital No 1.

Besides this, loss of income is a considerable expense. The children are accompanied by their parents/caretakers at all times. The parents/caretakers take care of washing, feeding and looking after the children. These chores are not done by the staff. Thus most parents lose their entire income during the time their child is admitted, while other children are accompanied by older siblings, grand parents or unemployed parents.

The cost of treatment increases significantly with the severity of the disease and the intensity of treatment. These two factors are naturally co-bound as long as the patients are treated according to the WHO guidelines. There is a considerable price difference between the treatments, as a dose of lactate ringer, which is the first choice crystalloid, costs 0.40 USD and a dose of Dextran, first choice colloid, costs 7.31 USD [7]. All fluids and medication are paid for by the families.

Even though the children with higher grade of disease are in the semi-emergency room longer, this has no effect on the family cost, as a bed in the semi-emergency room costs the same as a bed in a normal room.

Similar studies have been conducted in Thailand and Cambodia. Coincidentally, Clark et al [4] also found the average financial loss for one family to be approximately 61 USD in Thailand in 2005. This figure includes both direct and indirect cost, however it accounts for both DF and DHF which leads to the assumption that the figure for DHF alone must be higher. The Clark et al. study includes patients of all ages, but patients over 15 years only constitute a small percentage.

Van Damme et al [8] (Cambodia, 2004) come to the result that when using a combination of private and public health care providers, which was most frequently the case for the patients in our study, the average direct cost was 32 USD (32.73 in our study). Like Clark et al's study, however, Van Damme et al's study includes all ages and both DF and DHF.

Okanurak et al [9] found, in 1997, that the family cost per child with DHF was 118.29 USD in Bangkok and 102.82 USD in rural ar-

eas in Thailand when including direct and indirect costs. The difference in costs between Thailand and Vietnam is most likely explained by the economic differences between the two countries. Thailand is a richer country with higher price levels and higher GNI per capita, whereas Vietnam has extremely low wages and, as a result, lower hospitalization fees – even if these are quite expensive to the average Vietnamese family.

Van Damme et al's DF/DHF study from Cambodia shows that many families had to take loans or sell possessions in order to pay for health services, leading to indebtedness and poverty. Even though Cambodia is a somewhat poorer country than Vietnam, these findings are likely to be applicable to Vietnam as well.

Several DF vaccines are under development but none are close to approval. They are primarily targeted towards adult travellers and

western military personnel [10]. There is probably a long way to go regarding the development of a pediatric vaccine against DF not to mention the implementation in the national immunization programmes in those developing countries needing it most.

There are, of several reasons, problems with the financing of the development of the vaccine. The disease and its extent is not commonly recognized in Western countries, where the money for research is, and it is not the type of research that produces fast and tangible results that can be presented to potential investors. Furthermore the purchasers of the vaccine are developing countries with limited funds. Thus the funds for DF research are to be found in non-governmental organizations and governmental financial aid from Western countries, where the distribution of means, however, is dependent on media attention and other kinds of publicity.

Increased awareness of the existence and extent of DF/DHF may be part of solving the expanding problem that DF constitutes worldwide.

## Appendix

### Economic impact of DHF: Questionnaire

Date: \_\_\_\_\_ Case number: \_\_\_\_\_  
Date of admission: \_\_\_\_\_ Date of discharge: \_\_\_\_\_

#### Chart data

Information to be obtained from patient's chart

1. Name/hospital no. \_\_\_\_\_
2. Age \_\_\_\_\_ years
3. Sex M  F
4. Address HCMC  Province
5. Grade of DHF I  II  III  IV
6. Diagnosis confirmed by ELISA :  
Ordered date: \_\_\_\_\_ Positive  Negative
7. IV fluids None  Crystalloids  Colloids
8. No of admission days (days in emergency / days in normal room) \_\_\_\_\_/\_\_\_\_\_ days
9. Total hospital bill presented to family modified to cheapest room price \_\_\_\_\_ VD

#### Family level data

To be asked the parent/caretaker on patient's discharge

10. No of days ill prior to admission \_\_\_\_\_ days
11. Parent/caretaker's number of days away from work \_\_\_\_\_ days
12. Parent/caretaker's estimated daily income \_\_\_\_\_ VD
13. Amount spent on medications prior to admission \_\_\_\_\_ VD
14. Amount spent on doctor visits/admission to local hospitals prior to admission \_\_\_\_\_ VD
15. Additional laboratory tests \_\_\_\_\_ VD
16. Estimated transport expenses \_\_\_\_\_ VD
17. Extra expenses on food \_\_\_\_\_ VD
18. Means of payment:
- 18a. Family's own funds
- 18b. Insurance  \_\_\_\_\_ %
- 18c. Government/hospital contribution  \_\_\_\_\_ %

## CONCLUSION

The aim of the study was to estimate the cost for a family, when a child is admitted with DHF. The result was an average of 61 USD, when both direct and indirect costs were included. With a GNI per capita of 620 USD this is a substantial financial loss to the average Vietnamese family.

The family cost increases significantly with the grade of disease and thereby with the intensity of treatment, since all fluids and medications are paid for by the family.

The study illustrates that DF/DHF is a considerable socio-economic burden in Southern Vietnam.

Quantification of disease burden is of importance in accelerating the introduction of a potential DF vaccine.

In order to estimate the entire burden of disease due to dengue virus, a larger study including both DF and DHF, all age groups, and several hospitals is needed.

## ACKNOWLEDGEMENTS

We wish to thank the staff at the Dengue Hemorrhagic Fever Department and the staff at the Department of Microbiology at Children's Hospital No 1 in Ho Chi Minh City for their help with translation, blood sampling and analysis. Special thanks to MD Freddy Karup Pedersen, our supervisor on the OSVAL II thesis, and head of department Dr. Nguyen Thanh Hung whose invaluable help made this project possible.

The authors received funding from RUF, Oticon Fonden, Hotel-ejer Anders Månssons mindelegat and De Københavnske Uddannelseslegater.

\*) >20 petechiae per square inch appearing after applying pressure to the arm with a blood pressure cuff for five minutes.

## References

1. Dengue haemorrhagic fever, diagnosis, treatment, prevention and control. III. Treatment. Geneva: World Health Organisation, 1997:24-33.
2. [www.searo.who.int/en/Section10/Section332.htm/](http://www.searo.who.int/en/Section10/Section332.htm/) 16. Dec. 2006
3. Gubler DJ. Epidemic dengue/ dengue hemorrhagic fever: A global public health problem in the 21st century. *Dengue bull* 1997;21.
4. Clark DV, Mammen PM jr, Nisalak A et al. Economic impact of dengue fever/ dengue hemorrhagic fever in Thailand at the family and population levels. *Am J Trop Med Hyg* 2005;72:786-91.
5. Murray CJL. Quantifying the burden of disease: The technical basis for disability-adjusted life years. *Bull WHO* 1994;72:429-45.
6. <http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIP.pdf/> 12. Oct. 2006
7. Internal hospital records.
8. Van Damme W, Van Leemput I et al. Out-of-pocket health expenditure in poor households: evidence from Cambodia. *Trop Med Int Health* 2004;9:273-80.
9. Okanurak K, Sornmani S, Indaratna K: The cost of dengue hemorrhagic fever in Thailand. *Southeast Asian J Trop Med Public Health* 1997;28: 711-7.
10. Deen JL. The challenge of dengue vaccine development and introduction. *Trop Med Int Health* 2004;9:1-3.