



Childhood Dengue: An Overview on Cost-of-Illness in Asia

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Abstract

Dengue is an increasing public health problem in many regions of the world but Asia is the hardest hit. The economic burden at macro and micro level has been studied to varying extents. This paper reviews published literature on cost of dengue illness in Asia. The search was restricted to three databases, publications in English and from 2002 onwards. Comparisons are made with more comprehensive studies done outside this region and time period. The need for more extensive studies in Asia is highlighted.

Keywords: Asia; Economic cost; Dengue

Introduction

Dengue virus infection has emerged as the most-feared viral illness in the tropics [1-3]. The largest population at risk and the hardest hit are children living in Asia. Until mid-20th century dengue was mostly a disease in South East Asia although it is today of public health concern also in South Asia, the Caribbean, Central America, South America and even some parts of the United States (Puerto Rico) [4-6]. In temperate countries cases have surfaced in returning travelers [7].

In 2007 an outbreak of Chikungunya, which shares the same vector (*Aedes mosquito*) occurred in north-eastern Italy [8]. Local transmission was established and nearly one hundred persons were infected. With global warming threatening to alter disease epidemiology, dengue is the foremost mosquito borne viral disease that endangers the world's population.

The annual caseload of dengue viral infection globally, is estimated at between 50 and 100 million cases or even 500 million [1,4,9,10]. With World Health Organisation reporting a 30 fold increase globally, over the past half century the economic burden on developing countries in Asia warrants close scrutiny [11].

Methodology

A search of published literature on economic cost of dengue in Asian countries was carried out using the databases: PubMed, EMBASE and WHOLIS. The articles reviewed were restricted to those published in English from 2002 to 2013. The search criteria used "dengue", "economic cost", "economic burden", "cost-of-illness", "Cost of dengue" and only those from countries in South Asia and South East Asia were included. Abstracts or full texts of Original articles, Editorials and Communications were analysed for economic costs and related issues. Articles outside this region are cited in relation to issues surrounding studies on costing.

Epidemiology

Epidemics occur due to improper waste management and inadequate water drainage. Growth of cities, rapid urbanisation and overcrowding are associated with spread of dengue infection [12]. Lack of resources for effective prevention is a major contributor to expansion of this illness in developing countries. Breeding sites of *Aedes mosquito* being mostly in peri-domestic locations needs a high degree of public participation if governmental expenditure on vector control is to be effective. Preventive measures by households (mosquito coils and other repellents and barriers) create a significant economic impact at micro level. Financial impact of this disease has become particularly important in the developing world.

In 2012, *American Journal of Tropical Medicine and Hygiene* stated

that "dengue is likely to become more important than malaria globally in terms of morbidity and economic impact" [12].

Cost-of-illness in Asia

Dengue places a large burden on Asian countries. A projected national cost of 485 million USD was documented in Thailand in 2005 [13]. Of this total cost 72% was attributed to Cost of Illness (COI); and only 28% to vector control. COI was the main contributor to the economic burden of dengue in Thailand [13].

The clinical spectrum of dengue is such that majority present as undifferentiated viral fever or dengue fever, and only 1% have Dengue Hemorrhagic Fever (DHF), which is the dreaded form of the disease [14]. This creates inaccuracies in case ascertainment, when national level surveillance is lacking. Estimating COI at national level faces difficulties in assessing proportions of reported to unreported and hospitalised to non-hospitalised cases. [4,12,15].

Therefore cost of dengue in Asia is hazy [15]. A previous review of 43 dengue-related economic studies found most studies to be from the Americas where in 2010, annual estimated total cost of dengue was USD 2.1 billion [4,15]. Three Asian countries (Cambodia, Malaysia and Thailand) were included in an international study of eight countries, the remaining five being from Central and South America. Mean cost per case of hospitalised and non hospitalised dengue was reported as USD 571 and USD 248 for all eight countries [6].

It has been suggested that severe disease is more likely in children than adults [16,17]. This is based on a study in Nicaragua on age related differences in dengue severity found severe complications in 64%, 55% and 36% of infants, children and adults respectively [16]. Search for country specific data on cost-of-pediatric dengue illness in Asia, found considerable differences between countries. Variations in research methodology may account to these differences.

A study in Thailand involving three hospitals found hospital costs to be higher in the city than in the provinces [18]. Cost per hospitalization for Dengue Hemorrhagic Fever (DHF) was estimated at USD 162 in Bangkok and USD 138 in the provinces in 1994 [18]. In

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2005 cost per non-fatal hospitalized dengue in a provincial hospital in Thailand was USD 573 [13]. In a tertiary level private hospital in India cost per hospitalised dengue patient was USD 432 and private health sector expenditure was reported to be four times higher than the public sector [19]. In Cambodia, cost per case of serologically proven dengue was USD 35 and 75 in 2006 and 2008 [20]. Majority (67%) of rural households in Cambodia incurred large debts in times of acute febrile illnesses. The high financial burden of treatment was incriminated as causing low hospitalization rates of dengue infected children from poor homes in Cambodia [20,21]. In Southern Vietnam, financial impact at family level of DHF treated in hospital was USD 61 in 2005. This included hospital bills and other expenses [22]. The only study from Sri Lanka found hospitalized cost per case of DHF and Dengue Fever (DF) to be USD 191 and USD 79 in 2013 [personal communication]. In this prospective study in Colombo expenditure by hospital and households were compared. The state funded most of the cost. Cost to households was USD 37 and USD 30 per hospitalized case of DHF and DF respectively.

Discussion

Placing a monetary value on an acute illness with an associated mortality can be difficult. The fear element when children are infected with dengue is impossible to quantify. Societal costs, loss of school and loss of parental employment add to this aspect not covered by these studies [15].

However, the economic impact of dengue is essential for policy planning, decisions on preventive measures and prioritizing research. From a public health standpoint it involves expenditure of pesticides and larvicides, spraying/fogging equipment, publicity programs, legislative activities, public education efforts, laboratory surveillance and national level disease surveillance. In the clinical domain it involves expenditure incurred in clinics, wards, intensive care units and laboratories. These were found to outweigh the cost of vector control [13]. This discrepancy needs studying.

Different categories of patients need to be included in studies on COI because ambulatory dengue patients represent a substantial proportion of the burden. However most studies have assessed costs in hospitalized patients only [13,18-23]. Lack of accurate data on the non-hospitalised caseload is the cause of large gaps in information. To correct this, both hospitalised and ambulatory dengue patients of all age categories (adult and children), need to be studied prospectively [5]. Comprehensive studies of this nature are an urgent need in Asia.

Societal costs need scrutiny in terms of disease burden. The debilitating nature of this illness has been assessed using quality of life and disability scores. The number of days affecting daily activities has been estimated at 9 days for non-hospitalized and 13 days for hospitalized adult patients with higher values for children [24,25].

Dengue is listed as an infection that can cause 'catastrophic cost' to the family [21,26,27]. Debts persisting for long periods of time following dengue have been a consequence [28]. At household level there are direct costs (food transport, lodgings) and indirect costs (loss of parental income, cost of care-givers etc.) [12].

It is important that endemic countries look at dengue in economic terms. The available data points to the need for greater investment on preventive measures. Introduction of a vaccine is one such measure and monetary losses at country level are essential to justify immunization.

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