Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/vhri

Cost of Illness of Chronic Hepatitis B Infection in Vietnam

Hong Anh T. Tu, PhD[1,2], Herman J. Woerdenbag, PhD[3], Arthorn Riewpaiboon, PhD[4], Sumit Kane, MPH[5], Diep M. Le, MD[6], Maarten J. Postma, PhD[1], Shu Chuen Li, PhD[7,]*

[1]*Unit of PharmacoEpidemiology and PharmacoEconomics (PE[2]), Department of Pharmacy, University of Groningen, Groningen, The Netherlands;* [2]*Department of Pharmaceutical Management and Policy, Hanoi University of Pharmacy, Hanoi, Vietnam;* [3]*Unit of Pharmaceutical Technology and Biopharmacy, Department of Pharmacy, University of Groningen, The Netherlands;* [4]*Division of Social and Administrative Pharmacy, Department of Pharmacy, Mahidol University, Bangkok, Thailand;* [5]*Department of Development Policy and Practice, Royal Tropical Institute, Amsterdam, The Netherlands;* [6]*Bach Mai Hospital, Hanoi, Vietnam;* [7]*Discipline of Pharmacy and Experimental Pharmacology, School of Biomedical Sciences and Pharmacy, University of Newcastle, Callaghan, NSW, Australia*

A B S T R A C T

Objectives: To estimate the total financial burden of chronic hepatitis B virus (HBV) infection for Vietnam by quantifying the direct medical, the direct nonmedical, and indirect costs among patients with various stages of chronic HBV infection. **Methods:** Direct medical cost data were retrieved retrospectively from medical histories of inpatients and outpatients in 2008 from a large referral hospital in Hanoi, Vietnam. Direct nonmedical and indirect costs data were obtained from face-to-face interviews of outpatients from the same hospital. The treatment cost per patient per chronic HBV infection stage was multiplied by the total estimated patients in Vietnam to get the total cost of illness for the nation. **Results:** Nationally, the total cost attributable to chronic HBV infection and its complications in 2008 was estimated to be approximately US $4.4 billion, with the direct medical cost accounting for about 70% of that estimate. The cost of antivirals was the major cost driver in treating chronic HBV infection. The per-patient total annual direct medical cost increased with the severity of the disease, with the estimated costs for chronic HBV infection and hepatocellular carcinoma as US $450.35 and US $1883.05, respectively. When compared with the 2008 per-capita gross domestic product of ~US $1024, the financial burden of treating chronic HBV infection is very high in Vietnam. **Conclusions:** This study confirmed that chronic HBV infection poses a significant financial burden for the average patient and that lacking treatment would become a social issue in Vietnam. Although HBV vaccination has been universally implemented, more health care investment and the greater availability of affordable medications are still needed to attain equity in proper treatment for patients with HBV infection.

Keywords: chronic hepatitis B, cost of illness, direct medical cost, indirect cost.

Introduction

Hepatitis B virus (HBV) is one of the most prevalent blood-borne viruses worldwide, with chronic HBV infection afflicting more than 350 million people [1]. Major clinical consequences of HBV infection include liver failure, cirrhosis, and hepatocellular carcinoma (HCC) [2,3]. These complications lead to more than 1 million deaths each year [3–5]. Thus, HBV infection is an important public health problem, especially for developing countries where the endemicity is often either intermediate or high.

Vietnam is a high-endemic country for HBV infection [6]. Population surveys from the two biggest cities, Hanoi and Ho Chi Minh City, have shown a positive hepatitis B surface antigen (HBsAg+) rate of 9% to14% [7,8]. High HBsAg+ prevalence in Vietnam is supported by another small survey of children in rural regions. In this survey, the HBsAg+ rate was 19.5% [9]. While very little data exist in Vietnam on the proportion of patients who were HBsAg+ and have chronic HBV infection, cirrhosis, or HCC, the international literature has reported that 75% to 80% of patients with chronic HBV infection, 34% of patients with cirrhosis, and 72% of patients with HCC were also HBsAg+ [10]. Hence, chronic HBV infection and the resulting liver diseases would pose a heavy burden for the Vietnamese health care system.

At the per-capita gross domestic product of US $1024 [11], the cost of treatment for diseases stemming from HBV infection is significant for the average Vietnamese patient. Moreover, antiviral drugs remain expensive. Comprehensive analyses of the financial burden of HBV infection in Vietnam, however, are very limited. In view of this, we conducted a cost-of-illness study of HBV infection by using data from one major referral hospital in Vietnam and extrapolated the results nationally. Our analyses should provide the Vietnamese decision makers some guidance on resource allocation for health, particularly for HBV-related conditions.

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Shu Chuen Li, Discipline of Pharmacy and Experimental Pharmacology, School of Biomedical Sciences and Pharmacy, University of Newcastle, Callaghan, NSW, Australia.

E-mail: Shuchuen.Li@newcastle.edu.au.

2212-1099/$36.00 – see front matter

doi:10.1016/j.vhri.2012.03.008

Methods

The study contains two parts: 1) quantification of the direct medical cost and 2) quantification of the direct nonmedical cost and the indirect cost of HBV infection. The financial burden to the Vietnamese society is represented by the total cost (direct medical, direct nonmedical, and indirect costs) multiplied by the estimated number of infected subjects in Vietnam. The study protocol was approved by the Director of Bach Mai Hospital in Hanoi, where the study was carried out. Bach Mai Hospital, a 1400-bed hospital, is among the largest hospitals in Vietnam. It is a highly specialized multidisciplinary medical facility with a focus on internal medicine and the most active in treating hepatitis B patients in Hanoi. In the cost analysis, the study followed the bottom-up approach [12]. Direct medical costs were estimated from retrospective analysis. Direct nonmedical and indirect costs were obtained from patient interviews.

Part 1: Measurement of direct medical cost

Data were collected from medical and financial records of Bach Mai Hospital from January 1 to December 31, 2008. The records for all inpatients treated at the Department of Infectious Diseases and all outpatients treated at the Infectious Diseases Unit of the Outpatient Department were included.

By using the codes established by the International *Statistical Classification of Diseases, 10th Revision*, we identified and retrieved information on HBV patients classified under B18 (chronic HBV infection patients), K74 (compensated cirrhosis [CC] and decompensated cirrhosis [DC]), and C22 (HCC). Patients coded with K74 were subsequently differentiated as either CC or DC through clinical diagnosis from patient case notes.

Cost consideration

The total direct medical cost related to the treatment of chronic HBV infection and associated complications included clinic visit cost (outpatient visits and hospitalizations), investigation cost (laboratory tests and procedures), and drug costs (antiviral drugs and other medicines) and other services (bed costs, meals, etc.).

The study assessed resource utilization based on hospital charges in 2008 and was expressed in US $ (US $1 = VND17,803) [13]. Because Bach Mai Hospital is a public nonprofit health care institution with most service charges based on cost recovery, the use of charge for the estimation of costs would be the most appropriate approach [14].

Calculation of direct medical cost

The total annual direct medical cost per patient from each category of chronic HBV infection was calculated by the following formulae:

$$\text{Annual cost/patient} = \text{Cost/visit} \times \text{Visits/year} + \text{Cost/admission} \times \text{Admissions/year}$$

where visits/year = aggregated visits of observed patient cases/aggregated observed patient cases, and admissions/year = aggregated admissions of observed patient cases/aggregated observed patient cases.

Part 2: Measurement of direct nonmedical and indirect costs

Estimations of direct nonmedical (expenses on travel, accommodation, and meals) and indirect costs (medical leave, time off, and productivity loss) were collected through interviews of outpatients after informed consents were obtained. In the cases where no consenting subject for a particular category of clinical diagnosis (described above) was available, physicians were interviewed as surrogates for their opinions on the likely costs to the patient.

For the working group, medical leave and time off were the components for the indirect cost. The annual cost of day offs for medical leave was calculated by multiplying the days taken for medical leave by the average daily-wage rate. The annual time-off cost for outpatient visits was calculated by multiplying the total time off by the average hourly earnings. For daily and hourly wage calculation, a 5-day workweek and an 8-hour workday were assumed.

For the nonworking group, productivity loss was used as the indicator of indirect cost and was calculated by assuming that the minimum wage was the monthly wage [15].

Estimation of prevalence

To estimate numbers of HBV carriers and cirrhosis cases, data were extrapolated from the study on HBV infections and HBV-related cirrhosis in Vietnam in 2005, which were estimated at 10.05% and 481 per 100,000, respectively [16]. Assuming the same prevalence rate as in 2005 and extrapolating to the 2008 population of 86,084,547 in Vietnam [17], the estimated HBV carriers and patients with cirrhosis were 8,651,497 and 414,067, respectively. No official data on the ratio of CC to DC cases were available in Vietnam. By using the ratio of CC to DC (8:1) at Bach Mai Hospital as a guide, it would translate to approximately 368,059 CC and 46,007 DC cases.

The prevalence of HCC was calculated by multiplying the HCC incidence rate (estimated at 0.019% in 2005 [16]) with the average duration of HCC (estimation of 1 year [18–20]); HCC cases in Vietnam in 2008 were 16,356.

Subtracting the cirrhosis and HCC cases from total chronic HBV carriers, the number of chronic HBV infection cases was estimated to be 8,221,074.

Sensitivity analysis

For the direct medical cost, two one-way sensitivity analyses were performed. In the first sensitivity analysis, the lower and upper limits of the direct medical cost (95% confidence interval) were tested. In the second sensitivity analysis, the number of patients in different chronic HBV disease stages was varied as follows:

1. Using the prevalence rate of HBV-infected patients of 8% to 16% [7–9,21] as the lower and upper limits, respectively, for estimating the number of chronic HBV carriers;
2. Using survival times from 5 months to 16 months [22–24] as the lower and upper limits, respectively, for estimating the prevalence of HCC subjects; and
3. Applying the base-case ratio (4.79%) between cirrhosis cases and chronic HBV carriers [16] to the lower and upper limits of chronic HBV carriers to estimate the lower and upper limits for liver cirrhosis cases.

For direct nonmedical and indirect costs, two one-way sensitivity analyses were also performed. In the first analysis, the 25th and 75th percentiles of the indirect cost were tested. In the second analysis, the number of patients in each disease stage was varied as for the direct medical cost.

Two-way sensitivity analyses (best- and worst-case scenarios) were conducted to test the combined effects of varying both the number of subjects and the treatment costs.

Results

Direct medical cost

A total of 904 patient cases (470 outpatients and 434 inpatients) were included for analysis, consisting of 226 chronic HBV infec-