Assessment of Total Economic Burden of Chronic Hepatitis B (CHB)-Related Diseases in Beijing and Guangzhou, China

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ABSTRACT

Objective: To estimate the total annual cost due to Chronic Hepatitis B (CHB)-related diseases imposed on each patient and his/her family in Beijing and Guangzhou, China.

Methods: Economic burden of CHB-related diseases (CHB, compensated cirrhosis, decompensated cirrhosis, and hepatocellular carcinoma) were examined. A retrospective cohort of 328 patients in Beijing and 271 in Guangzhou were identified to obtain their socioeconomic status, utilization costs, and treatment, and work loss due to illness with a structured questionnaire. Costs of hospitalization were extracted from databases of two hospitals in Beijing and Guangzhou Social Insurance Information System, respectively. The outpatient expenditure per patient was measured through the rate of outpatient visits and average cost per visit reported by the patients, while the inpatient cost was calculated through annual rate of hospitalization and average expenditure for different types of hospitals. Self medication and direct nonmedical cost were also reported. The Human Capital Approach was employed to measure the work loss cost.

Results: The total annual cost per patient for CHB, compensated cirrhosis, decompensated cirrhosis, and hepatocellular carcinoma were US$1636, US$2722, US$4611, and US$6615 in Beijing, and US$1452, US$2065, US$4290 and US$6054 in Guangzhou, respectively.

Conclusion: This study confirms that CHB-related diseases impose a substantial economic burden on patients, families, and the society in China urban areas. The study demonstrates increasing health-care costs related to disease progression and provides useful information on cost of treatment and work loss for different disease states, which can be further utilized in cost-effectiveness evaluation.

Keywords: chronic hepatitis B-related diseases, cost of illness, economic burden, medical expenditure.

Introduction

Hepatitis B is a major global health concern and the most serious type of viral hepatitis. Worldwide, an estimated two billion people have been infected with the hepatitis B virus (HBV), which was the 10th leading cause of death in the world [1,2].

When a person is infected with HBV for more than 6 months, it is then classified as chronic infection. Attacking liver cells, chronic HBV can lead to cirrhosis, liver cancer, liver failure, and ultimately, death. Chronic hepatitis B (CHB), affecting approximately 350 million people worldwide, is responsible for up to 1.2 million deaths worldwide each year [1,3].

Among those chronically infected, 75% cases are found in Asia, China, as a highly endemic country, bears an estimated 122 million chronic carriers and 30 million CHB patients [4,5], of which between 15% to 25% will die from complications of chronic liver diseases such as cirrhosis and liver cancer [3]. In this article, CHB-related diseases are defined to include CHB, compensated cirrhosis, decompensated cirrhosis, and primary hepatocellular carcinoma (HCC). A study showed that the total economic loss resulted from CHB-associated diseases could be probably 58.6 to 107.8 billion RMB (US$8.5 to 15.6 billion) in year 2001 [6], which laid a heavy burden on the patients and their families as well as the whole society.

Estimating costs of illness due to CHB is an important public health issue. However, the exact total economic burden in China has not been well characterized. Since China is a big country with uneven socioeconomic development, we intentionally start with Beijing (the capital of China) and Guangzhou (the capital city of Guangdong Province, Southeast China), both of which are at the forefront of China’s economic and social development. Our study is to measure the average annual cost of CHB and its complications in Beijing and Guangzhou to illustrate the magnitude of the economic burden in the megalopolises of China.

Methodology

After a pilot investigation, considering the geographic location and socioeconomic condition, one urban community in Beijing and two urban communities in Guangzhou were typically sampled as the study sites. Containing all the relative information of the residents who have chronic health problems, the residents’ health records obtained from the information system of the community health center (CHC) where primary health care was delivered to the community residents were used to identify the patients diagnosed with any of the four conditions (CHB, compensated cirrhosis, decompensated cirrhosis, and HCC). In each community, all eligible patients were included and the retrospective cohorts were established to assess the economic impacts.

A structured household questionnaire survey was conducted among the included patients by pretrained professional investigators from CHCs during September 2007. The respondents were asked to present their disease state and recall the information about outpatient services utilization in last three months (from June to August 2007) and hospitalization in the past year (from September 2006 to August 2007). The questionnaire was designed to obtain detailed data including socioeconomic status (such as gender, age, education, occupation, health insurance), disease state (illness stages, definite time and result of diagnosis, follow-up result, and symptoms), utilization of medical and pharmaceutical treatment (times of visits, levels of facilities visited, types of examination, and medications prescribed, length of stay, surgical procedures and other therapies, and self-medications), specific expense on services at a time, other spending relevant to...
the disease (transportation, extra nutrition, etc.) as well as work loss days (both the patient and the caregivers).

Attributing to the recently updated information systems, patients on the sampling list could all be located and investigated. Moreover, since the household surveys were implemented by the community physicians who have quite a good relationship with the patients, there was few refusal or nonresponse. However, those who had not been confirmedly diagnosed so as not to be enrolled in the databases were excluded from the surveys, as it might cause selection bias.

To acquire the precise hospital costs, average expenses on hospitalization for the four CHB-related diseases were extracted from the database of one tertiary hospital and one secondary hospital in Beijing according to International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) code. Comparatively, the average inpatient costs at different hospital levels were obtained through the Social Insurance Information System in Guangzhou.

The total economic burden of CHB-related disease usually consists of two parts, direct economic burden, which can be further divided into direct medical cost and direct nonmedical cost, and indirect cost in 1-year time span [7]. In this study, all the cost was respectively calculated for each disease state above.

The direct medical cost, measuring the economic resources for health-care services utilized, was composed of the average outpatient expenditure, inpatient expenditure, and cost of medicines self-purchased in retail pharmacies. Annual outpatient or inpatient expenditure per patient was determined by the visit rate and the average expense per visit. The formulas were:

1. Direct medical cost = annual outpatient expenditure per patient + annual inpatient expenditure per patient + annual expenditure of self-medications per patient.
2. Annual outpatient expenditure per patient = average outpatient expense at a visit × average rate of outpatient visits in three months × 4.
3. Annual inpatient expenditure per patient = ∑ (average inpatient expense at a time × proportion of inpatients at the certain hospital level) × annual rate of hospitalization per patient.

Cost of transportation and extra health products due to illness were summed up to acquire direct nonmedical cost. With the mean of the monthly consumption claimed in the questionnaire, the average yearly amount could be measured.

As for indirect economic burden, the Human Capital Approach was adopted. The indirect cost of each family depended on the daily income and days of sick leave of the patient and the average daily income per caregiver, as well as the duration of their absence from work for the sake of nursing and caring.

Results

Features of Study Population

A total of 328 patients in Beijing and 271 in Guangzhou catalogued in four disease states were eligible and finally included in the cohort. The socioeconomic background of the sample in Beijing was provided by the display of the patients’ characteristics (Table S1). The proportion of male was higher than that of female. Generally, average age increased with disease progression. Among the patients, quite a few (27–46%) stayed retired or unemployed, whose income was comparatively low. In Guangzhou, similar situation was presented. However, much higher proportion of patients with CHB and compensated cirrhosis had to pay out-of-pocket in Guangzhou (P < 0.05) (see Table S1 at Assessment of Total Economic Burden of Chronic Hepatitis B [CHB]-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

Utilization and Cost of Medical and Pharmaceutical Treatment

Table S2 showed the patients’ utilization of medical treatment in the two cities. On average, patients went to take outpatient service once or twice every 3 months and were hospitalized more frequently with disease progression. Most of the hospitalization occurred in tertiary hospitals, implying that high cost predominated in the average expenditure (Table S2 can be found at Assessment of Total Economic Burden of Chronic Hepatitis B [CHB]-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

It can be observed that average expenditure per outpatient and inpatient visit generally increased as the disease progressed except for CHB in Beijing (Table S3). Besides outpatient visits and hospitalization stay, the patients self-purchased the medicines for different purposes according to physician’s prescription (Table S3 can be found at Assessment of Total Economic Burden of Chronic Hepatitis B [CHB]-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

It was important to observe any difference in the structure of direct medical cost between Beijing and Guangzhou (Table S3). In general, there was no particular trend in the rate of taking outpatient visit and having inpatient stay. It seemed all patients except those with HCC in Beijing significantly spent much more for every outpatient visit than their counterparts in Guangzhou. The average expenditure per hospitalization at different hospital levels in Guangzhou was, on the contrary, higher than that in Beijing, except for CHB (Table S3). But since the data were extracted from the hospital databases or medical insurance system but with no factual records, the truth remained unknown.

Economic Burden of CHB-Related Diseases

Direct Economic Burden

The direct economic burden was a sum of direct medical and nonmedical cost, including annual cost of outpatient visits, inpatient visits, and self-medications (Table S4), along with cost of health products and transportation (Table S5). By calculating, the direct economic burden for CHB, compensated cirrhosis, decompensated cirrhosis and HCC were US$1380, US$2282, US$3870, and US$6084 in Beijing and US$1355, US$1875, US$3816, and US$5472 in Guangzhou, respectively (see Tables S4 and S5 at Assessment of Total Economic Burden of Chronic Hepatitis B [CHB]-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

Indirect Economic Burden

The indirect economic burden of CHB-related disease was the cost estimated from the social perspective. Here the work loss of both the patient and his/her family members due to the diseases were taken into consideration. Although it varied in different disease states and cities, it was too substantial to be overlooked.
The indirect economic burden for the four diseases concerned were, sequentially, US$2,556, US$4,440, US$7,471, and US$5,331 in Beijing and US$97, US$190, US$474, and US$582 in Guangzhou (see Table S6 found at Assessment of Total Economic Burden of Chronic Hepatitis B (CHB)-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

**Total Economic Burden**

To sum up, the total annual economic burden per patient were ultimately as follows: US$16,366 for CHB, US$27,722 for compensated cirrhosis, US$46,111 for decompensated cirrhosis, and US$66,155 for HCC in Beijing, while in Guangzhou they were US$14,522, US$20,655, US$42,900, and US$60,540, respectively.

The direct medical cost constituted the majority of the cost, 58% to 83% in Beijing and 70% to 83% in Guangzhou. The direct nonmedical cost corresponded to 9% to 26% of the total amount in Beijing and 8% to 20% in Guangzhou, while 8% to 16% of the all-in cost in Beijing as well as 7% to 11% in Guangzhou were distinguished as indirect economic burden (see Table S7 found at Assessment of Total Economic Burden of Chronic Hepatitis B (CHB)-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

As for the intensity of the burden, Figure S1 demonstrated the case briefly. The direct medical cost of the four diseases accounted for 28% to 208% in Beijing and 37% to 163% in Guangzhou of the individual income annually. As the gross domestic product (GDP) per capita of Beijing in 2006 was US$73,14, the economic burden of CHB, the least heavy of the four, was almost a quarter of the amount, to say nothing of HCC, whose cost even approached the threshold (see Fig. S1 found at Assessment of Total Economic Burden of Chronic Hepatitis B (CHB)-Related Diseases in Beijing and Guangzhou, China Value in Health Supporting Information at: http://www.ispor.org/Publications/value/ViHsupplementary/ViH12s3_WChen.asp).

**Discussion**

To our knowledge, only few prior studies had attempted to estimate the cost of CHB-related diseases in China. One study employed the national health statistics data, but lacked in empirical evidence of the cost on the individuals [6]. Another study was initiated to quantify the partial economic impact merely with data of direct medical cost [8]. Furthermore, this study, along with the other one published in 2002 [9], only took a sample of inpatients and outpatients from hospitals, which might overestimate the service utilization. According to the data, the life-long medicial expense for a 30-year-old CHB patient was expected to be US$21,131 through the Markov model [10].

As some studies on similar topics have been conducted with claims data from health insurance organizations [6] or patients’ medical records from hospitals [8,9], we mainly employed the data collected from community field surveys. There were at least two reasons for doing so. First, we acquired the realistic and detailed information instead of the limited claims numbers to genuinely detect the resource utilization in management of CHB-related diseases. Second, records in hospitals could only reveal the condition of those who “took health care,” but did not concern patients who were not well treated or who were cared at community level. Only when the cost could not be accurately obtained from the survey did we turn to hospitals or health insurance information system for supports.

Besides the physical and psychological agony of suffering from the disease, the patient and his/her family also underwent a significant economic pressure. The total annual cost of the diseases concerned was from the minimum US$14,52 to the maximum US$66,155, but the GDP per capita of China was only US$2,331 in 2006. The cost was also massive enough to be equivalent to a considerable proportion of the household income in both cities. Especially, with disease progressing, direct cost of decompensated cirrhosis or HCC exceeded 40% of the disposable household income, which might be regarded as a catastrophic expenditure [11,12]. Owing to the large amount of economic resources consumed, CHB-related diseases did impose a substantial economic burden on patients, families and the society in China, at least in the urban areas. The detailed cost estimates could be further utilized to evaluate the cost-effectiveness of interventions and support policy decisions on resource allocation.

For both the rate and cost of hospitalization increased for patients with more advanced CHB-induced liver diseases, the entire cost would likely be saved or relieved by effective vaccination or therapies to prevent, delay or reverse the disease progression. This useful information revealed a necessity for prevention and early treatment.

Direct nonmedical cost and indirect economic burden due to sickness were seldom estimated before. In our study, the expenses on transportation, extra health products were taken into account and further a considerable proportion of un-conspicuous work loss cost was also contained. However, only sick leave rather than job loss or decreased productivity in other forms was involved, meaning that the actual indirect cost might be higher.

It would be even better to adopt the incidence-based approach, which estimated the cost of illness from onset to conclusion for all cases that begin within the period under study, to figure out the lifetime costs of the patients. Nevertheless, limited by the access to information to track the residents’ long-term use of health services, we could not but exercise the alternative, the prevalence-based approach, to measure the cost of illness in the study period regardless of the date of onset of the disease. Compared with the lifetime economic burden, these figures had their defects, but could still provide such kind of information on the basis of which economic appraisals for intervention schemes or therapeutic regimens would be developed.

Beijing, the capital of China with a 16 million population, is the hub of policy and culture in China. Guangzhou, located in southeast China and with a GDP per capita of US$9,145 in 2006, is the city full of economic vitality. Though there existed slight differences in utilization and cost of the single service and then the total costs, the figures in the two cities could be generalized to most of the metropolises with great population density, economic prosperity, and civilized development in China, where patients can get the best health care but have to bear the heaviest economic burden. Eventually, it was worth mentioning that Beijing and Guangzhou were chosen because of their relatively complete health information systems that made the patients identification feasible.

**Conclusions**

This study confirms that CHB-related diseases impose substantial economic burdens on patients, families, and the society in China urban areas. The cost would likely be saved or relieved by effective prevention and early treatment. The study provides useful information on cost of treatment and work loss for different disease states and also demonstrates increasing health-care costs.
related to disease progression. These can be further utilized in cost-effectiveness evaluation of treatment interventions.

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Min Hu and Wen Chen have no conflicts to declare.

References