

# Comprehensive Cost of Illness of Three Major Diseases in Japan

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*Objective:* The purpose of this study was to calculate the burden of 3 major diseases (cancer, heart disease, and cerebrovascular disease [CVD]) using the cost of illness (COI) method. *Methods:* As a modification of the original COI method developed by Rice, the estimated comprehensive COI (C-COI) of cancer, heart disease, and CVD were redefined. C-COI consists of medical direct, morbidity, and mortality costs (MtCs; components of the original COI); long-term care (LTC) direct cost (DC); and family burden (FB). LTC DC is an insurance benefit, and FB is the unpaid care cost incurred by the family, relatives, and friends for in-home and in-community medical expenses (opportunity cost). All costs for 2008-2014 were calculated using official statistics of the Japanese government. *Results:* The C-COI of cancer, heart disease, and CVD in 2014 amounted to 9815 billion Japanese yen (JPY), 4461 billion JPY, and 6501 billion JPY, respectively. As for the composition of the C-COI, the MtC accounted for the largest portion of medical expenses for treatment of cancer (63.5%) and heart disease (50.6%), but the DC (LTC) accounted for the largest portion of medical expenses for CVD (26.7%). *Conclusions:* This study, based on government statistics, demonstrated that C-COI, including LTC DC and FB, could be estimated, and the latter was found to be a major cost component in CVD, whereas long-term disability is a salient feature of the disease. **Key Words:** Cerebrovascular disease—cost of illness—heart disease—cancer—long-term care—health policy.

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Received May 17, 2017; revision received June 7, 2017; accepted June 9, 2017.

Authors' contributions: K.M. participated in the design of the study, performed the data collection and the analysis, and drafted the manuscript. S.H. and Y.W. performed the data collection and the analysis. T.H. conceived of the study, and participated in its design and helped to draft the manuscript. All authors read and approved the final manuscript.

Grant support: This work was supported by JSPS KAKENHI Grant Number 15K08569.

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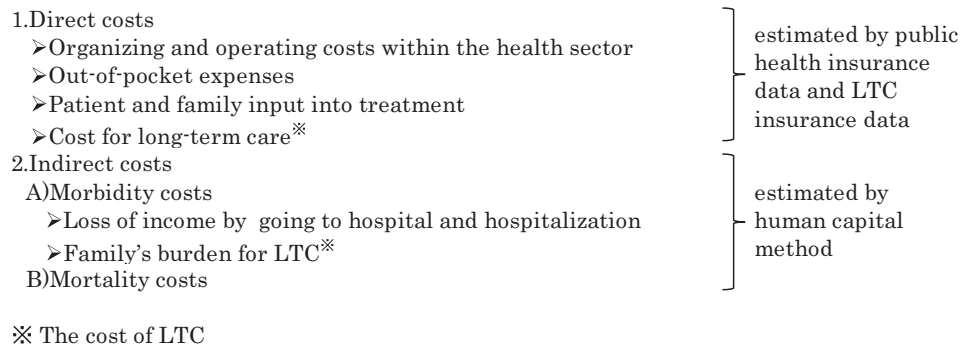
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<http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2017.06.022>

## Introduction

In 2011, the Organization for Economic Co-operation and Development revised the System of Health Accounts (SHA).<sup>1</sup> According to this revision, long-term care (LTC), as a portion of the national medical expenditure, now includes services related to activities of daily living and instrumental activities of daily living.<sup>2</sup> This revision reflects changes in the cost structure of health care. In aged societies, LTC cost continues to increase and is becoming an essential part of the national health expenditure. Total health expenditure as a percentage of gross domestic product in Japan increased from 10.2% in 2013 (based on a previous version of SHA) to 11.4% in 2014 (based on SHA 2011). Japan, which is a super-aged society (citizens aged ≥65 years accounted for 26.0% of the population in 2014), faces larger medical expenditures than before.

Here the social burden of 3 major diseases, that is, cancer (International Classification of Diseases [ICD] 10 code:



**Figure 1.** Breakdown of the comprehensive cost of illness. Abbreviation: LTC, long-term care.

C00-D09), heart disease (I01-I02.0, I05-I09, I20-I25, I27, and I30-I52), and cerebrovascular diseases (CVDs; I60-I69), including LTC costs, is estimated. Although this method has been criticized,<sup>3-5</sup> it has some methodological advantages.<sup>6-9</sup> In particular, it has the advantage of being relatively simple to calculate and uses data that are easy to obtain. Originally, the cost of illness (COI) consisted of both the direct cost (DC) and the indirect cost (IC). Normally, IC consists of costs associated with morbidity and mortality. The social burden of some acute diseases using the COI method has been reported.<sup>10-14</sup> However, the original COI has the disadvantage that it cannot adequately measure the burden of chronic diseases, whereas LTC costs account for a significant portion of the social burden. LTC cost is composed of two components: public LTC insurance benefits (LTC DC) and family burden (FB) of LTC (cost of informal care). But, the notion of IC varies, and it is difficult to comprehensively measure the social burden.<sup>15-20</sup> In previous studies, the sample size, which was the basis of cost calculation, was small.<sup>21-24</sup> In this study, the comprehensive COI (C-COI) was defined as follows:

$$\begin{aligned} \text{C-COI} = & \text{medical DC (MDC)} + \text{LTC DC} \\ & + \text{morbidity cost (MbC)} + \text{mortality cost (MtC)} \\ & + \text{FB of LTC} \end{aligned}$$

Three major diseases were the leading causes of death in Japan from 1958 to 2010. These diseases still continue to be serious social burdens. Cancer was the first leading cause of death in 2015, heart disease was the second, and CVD was the fourth. The number of deaths due to CVD is decreasing, while those attributable to cancer and heart disease are increasing because of societal aging. However, the structures of the social burdens among these diseases can vary. Therefore, the purpose of this study was to calculate the financial burden of these diseases using the C-COI method.

## Methods

Our study subjects were people whose major disease or main cause of requiring care was cancer (ICD 10 code:

C00-D09), heart disease (I01-I02.0, I05-I09, I20-I25, I27, and I30-I52), and CVDs (I60-I69). Our C-COI was calculated using incidence-based and top-down approaches.

The original COI, which was developed by Rice,<sup>25,26</sup> consists of the DC and the IC. Here, the original COI method we applied, and the C-COIs for 2008, 2011, and 2014 were calculated, adding LTC-related costs to both the DC and the IC. The breakdown of the C-COI is shown in Figure 1.

MDC accounts for the medical costs directly related to the disease and include costs associated with treatment, hospitalization, testing, and drugs. Here, the annual medical costs were calculated from the total medical expenses using the Survey of National Medical Care Insurance Services.<sup>27</sup> As for the LTC DC, the LTC cost covered by public LTC insurance was considered the DC. As most in-facility and in-home care provided by professionals is covered by public LTC insurance, the LTC DC was calculated as the total amount of LTC insurance benefits, including out-of-pocket cost (10%), using the Survey of Long-Term Care Benefit Expenditures.<sup>28</sup>

The original IC consisted of the opportunity costs resulting from disease (MbC) or death (MtC). Here, the cost to the family resulting from LTC (FB) was added. The MbC, MtC, and FB were calculated using the following equations:

$$\text{MbC} = \text{TOVy} \times \text{LVd}/2 + \text{THD} \times \text{LVd}$$

$$\text{MtC} = \text{NDy} \times \text{LVl}$$

$$\text{FB} = \text{NFC} \times \text{ATCd} \times \text{LVh} \times 365$$

where TOVy is the total person-days dedicated to outpatient visits, LVd is the one-day labor value per person, THD is the total person-days of hospitalization, NDy is the number of deaths, LVl is the lifetime labor value per person, NFC is the number of family caregivers, ATCd is the average time for care a day, and LVh is the 1-hour labor value per person.

TOVy and THD for 5-year age groups were calculated based on a patient survey<sup>29</sup> conducted by the Japanese government every 3 years. The labor values of the 5-year age groups were determined based on data from the Basic

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