ORIGINAL ARTICLE

Estimation of the Financial Burden to the National Health Insurance for Patients with Major Cancers in Taiwan

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Background/Purpose: Almost all countries that have national health insurance schemes face financial challenges. A better understanding of the financial burden that cancer places on Taiwan's National Health Insurance (NHI) is important for helping policy makers to plan under scarce healthcare resources. This study attempts to estimate lifetime health expenditure for patients with 17 types of major cancers.

Methods: A total of 425,294 patients, each of whom was registered in Taiwan during 1990 to 2001 as having one of 17 major types of cancers, were included. All of them were followed until the end of 2004. Monte Carlo simulation was used to extrapolate survival for up to 600 months to derive the life expectancy or lifetime survival function after diagnosis for different cancers. The average annual health expenditure per case for each cancer type was calculated by using data from the NHI's reimbursement database. The lifetime health expenditure per case was estimated by multiplying the monthly survival probability by the average monthly health expenditure, adjusting for the annual discount rate and the medical care inflation rate. By incorporating the number of annual incidence cases, the total lifetime health expenditure can also be estimated.

Results: Of the 17 cancers studied, it was found that leukemia had the highest average annual health expenditure per case (207,000 TWD) as well as the highest lifetime health expenditure per case (2,404,000 TWD, without discounting adjustment). Breast cancer had the highest total lifetime health expenditure (5046 million TWD) because of the longer life expectancy and chronic morbidity. Furthermore, colorectal cancer had the second highest total lifetime health expenditure (4995 million TWD) due to its high incidence.

Conclusion: The proposed method is a feasible way of estimating lifetime health expenditure for cancer patients even under high censoring rates. This would be helpful for cost-effectiveness assessment of cancer prevention programs and for policy planning. [*J Formos Med Assoc* 2008;107(1):54–63]

Key Words: cancer, health expenditure, health insurance, Monte Carlo method

Cancer is a major public health issue, due to both the suffering it causes and the financial burden that it places on patients and their families. In England, currently about one person in three develops a cancer in their lifetime, and cancer causes about one in four deaths.[1] In Taiwan, claims for the reimbursement of medical expenses for the diagnosis and treatment of cancer

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on the National Health Insurance (NHI) scheme were the second highest among major illnesses and injuries.[2] The amount of reimbursement represents a cause for concern regarding the maintenance of the NHI, given the scarce resources and increase in medical expenses for diagnosing and treating cancers. Measuring the financial burdens on patients with cancers could be helpful for financial planning,[3–5] as well as for the long-term maintenance of the NHI. However, previous studies have focused mostly on cross-sectional analysis of the financial burdens of cancer for a short period of time. The results of these studies may be useful for policymaking regarding cancer patients with short-term life expectancy.[6] However, there remains a need to estimate lifetime financial burdens,[7] which could be useful for the evaluation of the cost-effectiveness of prevention programs or new medical treatments.[8] The need for such evaluation is urgent in Taiwan, where all medical costs related to the diagnosis and management of cancer are reimbursed comprehensively by the NHI.

To estimate the lifetime health expenditure for cancer patients, the lifetime survival function must be calculated first. The Monte Carlo method can be used to estimate the lifetime survival function beyond the follow-up limit with a certain degree of accuracy.[9] It has been applied to patients who have serious diseases or conditions that lead to premature mortality, such as permanent occupational disabilities,[10] transfusion-dependent thalassemia,[11] and human immunodeficiency virus infection.[12]

In addition, the Taiwan NHI reimbursement database, which covers 97% of the population,[13] was used to estimate lifetime health expenditure for cancer patients. To the best of our knowledge, no previously published study has estimated lifetime health expenditure for cancer patients in Taiwan. Therefore, the main objective of the study reported herein was to estimate the lifetime health expenditure for cancer patients paid by the NHI. The estimate was made by analyzing data from national databases: the National Cancer Registry database, the National Mortality database, and the NHI's reimbursement database.

Methods

Subjects

A total of 425,294 cancer patients were recruited. The patients were grouped into 17 cancer cohorts according to the cancer sites, which were determined based on the code of the International Classification of Diseases taken from the National Cancer Registry database for the period from 1990 to 2001. Patients were followed up to the end of 2004 and the survival status for each cancer patient was obtained by linking the patients' identification (ID) and demographic information between the National Cancer Registry database and the National Mortality database. The 17 major cancer sites were as follows: oral cavity, nasopharynx, esophagus, stomach, colorectum, liver, gallbladder and extrahepatic bile duct, pancreas, lung, leukemia, skin, breast, cervix uteri, ovary, prostate, bladder, and kidney and other urinary organs.

Method for extrapolation of life expectancy

After 15 years of follow-up, the lifetime survival can be obtained for patients with cancers that yield a short life expectancy, such as liver, lung and pancreas cancers. However, there are several cancers that needed projection estimations. For these cases, we used the method proposed by Hwang and Wang[9] to extrapolate the long-term or lifetime survival curve beyond the follow-up period. The approach was to borrow the information from the age- and gender-matched reference population, of which the survival function can be obtained from the life table of the general population in Taiwan. The extrapolation process comprised three phases. First, we chose a reference person of the same age and gender with a known hazard function in the life table of the general population from the National Vital Statistics. The survival function of the reference person was then generated according to the Monte Carlo method. Thus, for the cohorts of each type of cancer, we were able to produce an age- and gender-matched reference population and their survival