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CONCEPTUAL PAPER

Reconciling Cancer Care Costs Reported by Different Government Agencies in Taiwan: Why Costing Approach Matters?

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ABSTRACT

Objectives: Few studies have explored how differences in costing methods may contribute to a discrepancy in the cost of cancer reported by different government agencies. **Methods:** By using claims data of cancer patients and controls identified from 2005 to 2007 claims data in Taiwan, we sought to understand the discrepancy in public reporting of cancer care costs by comparing four costing methods on the basis of the definition of cancer and cancer-related services employed by three agencies: Department of Health, Bureau of National Health Insurance (BNHI), and National Health Research Institute (NHRI). We also compared two costing approaches, the attributable cost approach versus the net cost approach, in terms of total cost, number of cancer cases, and average cost per patient. **Results:** The estimated total cost of cancer was highest (1.65 billion relative value units [RVUs] in 2005) from the NHRI method and lowest from the Department of Health method (1.20 billion RVUs). The Department of Health and NHRI methods tended to report higher number of cancer cases than did the BNHI and net cost methods. The estimated cost per patient was lowest from the NHRI costing method (34,139 RVUs) and highest from the BNHI method (94,115 RVUs). Projection to national cost showed that the percentages of national health expenditure for cancer ranged from 3.9% to 5.3% in 2005. **Conclusions:** The estimated costs of cancer care can vary widely (more than 10 billion New Taiwan dollars) by costing methods. The BNHI costing method appeared to produce estimates similar to those produced by the net cost approach.

Keywords: attributable cost approach, cancer, costing approach, net cost approach, Taiwan.

Introduction

Cancer is a costly disease, and the rising cost of cancer therapies has become a major concern for policymakers worldwide [1–3.] The estimated national health expenditure for cancer in Taiwan in 2010 was about 80 billion New Taiwan dollars ($NT), which is equivalent to about US $4.7 billion (year 2011 US dollars) [4–6]. Estimates from the United States showed that more than 90% of the new anticancer drugs approved by the Food and Drug Administration since 2005 cost more than US $20,000 for a 12-week course of therapy [7]. As new therapies enter the market and become part of health insurance programs, timely forecasts of the economic impact of such costly therapies are of strategic importance.

Cancer care cost can be measured in terms of the cost of cancer-related medical services (the "attributable cost" approach) or in terms of the incremental cost between cancer and noncancer populations (the "net cost" approach) [8,9]. Both the attributable and net cost approaches have been used in the literature [3,10,11], and each carries its own specific challenges. Measuring the attributable cost carries the challenge of defining cancer-related medical services [8,9], whereas measuring the net cost faces the challenge of constructing a control group, which may lead to negative net costs for some patients [9], To date, researchers have not reached an agreement on the best approach to use when estimating the cost of cancer.

The cost of cancer care in Taiwan can be found in the annual reports of two government agencies, the Department of Health (DOH) and the Bureau of National Health Insurance (BNHI) [12,13]. Although both agencies apply the same costing approach, the attributable cost approach, to estimate the annual medical costs of cancer, the costs reported by each agency vary widely. The estimated medical cost of cancer in 2010 was approximately 43 billion $NT (US $2.5 billion) and 51.6 billion $NT (US $3.03 billion) in the annual reports of DOH and BNHI, respectively [4,6,12,13]. Furthermore, the net cost approach—the approach routinely used by the National Cancer Institute in the United States to estimate cancer care costs [10]—has not been employed in the estimation of cancer costs in Taiwan.

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

This study is based on the data from the National Health Insurance Research Database, which is provided by the Bureau of National Health Insurance and managed by the National Health Research Institute in Taiwan. The interpretations and conclusions do not represent those of the Bureau of National Health Insurance nor the National Health Research Institute.

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The objectives of this study were twofold. First, we sought to reconcile the differences in the official statistics of cancer care costs among government agencies by analyzing the national health insurance claims data to explore reasons contributing to such discrepancies. Second, we compared the cost of cancer in Taiwan estimated from two costing approaches, the attributable cost versus the net cost approaches. This comparison makes a unique contribution to the literature because the concluding remark from a recently published *Medical Care* special issue focusing on methods of estimating the medical costs of cancer specifically emphasized a need for studies that compare cost estimates based on the two approaches [14].

Methods

Data source

The National Health Insurance (NHI) program of Taiwan and its national electronic database, the National Health Insurance Research Database (NHIRD), were established in 1995 [15,16]. Services covered under the NHI include outpatient visits, hospitalization, home nursing care, certain screening and preventive services, laboratory tests, diagnostic imaging, and dental care, among others [16,17]. The national electronic database consists of an enrollment file and original billing records for all services covered by the NHI. To facilitate the use of these data for clinical and health services research, the National Health Research Institute (NHRI) created a research database (the NHIRD) with deidentified beneficiary identifiers that allow for linkage between enrollment records and claims from various types of health care facilities. Researchers in Taiwan who are interested in using the NHIRD for research purposes can follow a standard application procedure to gain permission for accessing the data [18]. Because the program is compulsory and very few people meet the criteria of exemption, the NHIRD is a reliable source for population-based studies of health care utilization and costs and has become an important data source for health services and outcomes research since its inception. As of January 14, 2012, the NHIRD had been used in more than 400 publications [18].

For this study, we used the 2005 to 2007 ambulatory care expenditures, inpatient expenditures, and enrollment files from the Longitudinal Health Insurance Database 2005 (LHID2005). The LHID2005 is a subset of the NHIRD that collects all the current and historical claims data of 1 million beneficiaries who were randomly sampled from the 2005 enrollment file [18]. The ambulatory care files provide the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnosis (up to three) and procedure codes, as well as the medical expenditure of each outpatient visit. The inpatient files provide similar information for each inpatient visit, with up to five diagnosis codes. Other files from the NIHRD database used in our study included the Registry for Catastrophic Illness and the Cancer Dataset. The Catastrophic Illness Registry file was included because cancer is one of the diseases covered by the catastrophic illness program, which waives copayments for expenses related to the disease that qualifies patients to the program. Registration in the Catastrophic Illness Registry file with a cancer diagnosis has been used as an approximation of incident cases of cancer [19]. The Cancer Dataset consists of a subset of cancer-related claims extracted from the ambulatory care files of the entire population in Taiwan [18]. Our comparison of costing methods was based on estimates from the LHID2005, a 5% random sample of the original NHIRD; therefore, data files in both the Catastrophic Illness Registry and the Cancer Dataset were linked to the LHID2005 through unique patient identifiers, and only individuals with valid records in the LHID2005 were included in our analyses.

This study was exempt from the institutional review board because all personal identifiers in the NHIRD database had been deidentified prior to releasing the data to researchers whose data request application was approved [18,20].

Costing methods

Linkage between the NHIRD and the Taiwanese cancer registry was not available for the public use NHIRD database at the time of our study [18,21]. Hence, we estimated the cost of cancer care according to the definitions used by the DOH and the BNHI, the two government agencies reporting cancer care costs in Taiwan. In addition, we added cancer cases defined by another government agent, the NHRI. Although the NHRI does not publish its own estimate of cancer care costs, it generates the Cancer Dataset, which can potentially provide a third cost estimate by summing up the amount of payment for all cancer-related services. It should be noted that payment amounts in the NHIRD claims data are reported as relative value units (RVUs), instead of monetary units (e.g., $NT s). Because the dollar value of RVU fluctuates according to the global budget payment of the NHI program and the overall claims submitted within a given category of services [12,13,22,23], government agencies in Taiwan use RVU as a monetary surrogate when reporting medical costs of various diseases. To facilitate comparisons with public reporting of cancer care costs, we also reported costs estimated from our study in terms of RVUs.

We compared the attributable cost approach and the net cost approach through four definitions of "cancer care costs." The three cost definitions under the attributable cost approach correspond to cancer care statistics reported by three government agencies in Taiwan: the DOH, BNHI, and NHRI. To explore reasons behind the discrepancies in the numbers reported by different agencies, we applied the case identification criteria employed by each government agency to various files in the LHID2005 database to replicate the estimates of cancer care cost. The definitions of cancer care costs examined in our study are described below.

Cancer care costs defined by the DOH (DOH-like costing method)

The DOH defines cancer-related services as inpatient or outpatient visits with a cancer diagnosis code as the primary diagnosis [23]. We identified cancer cases as those who had a claim with a cancer-related *ICD-9-CM* code [*ICD-9-CM* 140.xx–208.xx] as the primary diagnosis in the ambulatory care or inpatient file.

Cancer care costs defined by the BNHI (BNHI-like costing method)

The BNHI defines cancer cases as those who enrolled in the Catastrophic Illness Program because of cancer and identifies cancer-related medical care services from service items in the claims data that were exempt from a co-payment. As mentioned earlier, under the Catastrophic Illness Program such an exemption is granted to a patient for cancer-related services following a diagnosis of cancer and is subject to physician and post hoc BNHI approval for each exempt service [17,24]. We followed the above criteria to identify cancer cases from the Catastrophic Illness Registry file and then linked those individuals to the LHID2005 database. Cancer-related services were captured as any inpatient or outpatient claim with a cancer diagnosis in any data field that recorded *ICD-9-CM* diagnosis codes plus a special remark field in the data indicating an exemption from co-payment for a catastrophic illness.

Cancer care costs defined by the NHRI (NHRI-like costing method)

The NHRI defines cancer-related services as visits with a cancer diagnosis, or a cancer-related *ICD-9-CM* procedure code (V57, V58), or a cancer-related treatment code specifically used by the NHRI [18]. The NHRI then applies these criteria to the ambulatory care file to create the Cancer Dataset. Therefore, we identified cancer cases directly from the Cancer Dataset, linked those individuals to the LHID2005, and applied NHRI's definition of cancer-related services to both ambulatory care and inpatient files.