ORIGINAL ARTICLE

Cost effectiveness of cancer treatment in Taiwan

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Background/Purpose: This study aims to examine the cost effectiveness of treating major cancers compared with other major illnesses in Taiwan.
Methods: We collected data on 395,330 patients with cancer, 125,277 patients with end-stage renal disease, and 50,481 patients under prolonged mechanical ventilation during 1998—2007. They were followed for 10—13 years to estimate lifetime survival functions using a semiparametric method. EuroQol five-dimension was used to measure the quality of life for 6189 cancer patients and 1401 patients with other illnesses. The mean utility values and healthcare costs reimbursed by the National Health Insurance were multiplied with the corresponding survival probabilities to estimate quality-adjusted life expectancies and lifetime costs, respectively. Data of 22,344 cancer patients under hospice care (considered as a comparison group) were used to conduct a cost-effectiveness

analysis. Sensitivity analysis was conducted by assuming patients without treatment survived for 2 years with a quality of life value of 0.5.

Results: The costs of care for patients under prolonged mechanical ventilation and those with end-stage renal disease were US$41,780—53,708 per quality-adjusted life year (QALY) and US$18,222—18,465 per QALY, respectively, which are equivalent to 2.17—2.79 gross domestic product (GDP) per capita per QALY and 1.18—1.25 GDP per capita per QALY. The costs of care for the nine different cancers were less than 1 GDP per capita per QALY, with those of lung, esophagus, and liver cancers being the highest. Sensitivity analysis showed the same conclusion. Lifetime risks of six out of nine cancer sites show an increased trend.

Conclusion: Cancer care in Taiwan seemed cost effective compared with that of other illnesses, but prevention is necessary to make the National Health Insurance more sustainable.

Introduction

Cancer is one of the leading causes of death worldwide and accounted for 8.2 million (22%) deaths in 2012.[1] The burden of cancer is also increasing due to the aging population in many countries, and thus cancer-related healthcare expenditures are growing rapidly. Taking Taiwan as an example, the total number of prevalent cancer cases was 463,703 in 2012, and they accounted for 10.2% of the total expenditures of the National Health Insurance (NHI) system.[2] There is thus a growing concern about the financial burden of caring for cancer patients in Taiwan, and there is a need to make cancer treatment care more efficient.[3,4]

Cost-effectiveness analysis has been recommended as a method to assess national healthcare programs in many countries.[5–7] However, the methodology has not been systematically applied to quantify how many dollars are spent per quality-adjusted life year (QALY) gained for cancer care in Taiwan's NHI system. Currently, there is an urgent need to improve resource allocation in the NHI, and to make more efficient and fair decisions regarding cancer prevention and treatment policies.

This study utilized a generalized cost-effectiveness analysis method[8] to estimate the lifetime cost per QALY for different cancer sites and for selected patients under hospice care as a comparison group to conduct a quasi-incremental cost-effectiveness ratio (quasi-ICER). The results were compared with those estimated from patients with end-stage renal disease (ESRD) and patients under prolonged mechanical ventilation (PMV). We hope that the estimates from this study can help in deriving a more sustainable policy for cancer care in Taiwan.

Methods

Study population and datasets

The study commenced after gaining approval of the Institutional Review Board of the National Cheng Kung University Hospital, Tainan, Taiwan (IRB number: ER-102-034, A-ER-101-089). Data of 395,330 patients with pathologically verified cancer registered with the Taiwan Cancer Registry and 125,277 patients with ESRD (ICD-9-CM code: 585) registered under "catastrophic illnesses" during 1998—2007 in the NHI were collected through the National Health Insurance Research Database and followed until 2007—2010, as summarized in Figure 1. The reimbursement data file obtained from the NHI of Taiwan was transformed into a research database by the National Health Research Institutes (in Chunan, Taiwan).[9] Identification numbers of all individuals in the file were encrypted to protect their privacy. These files contained detailed demographic data (including birth date and sex) and information regarding the healthcare services provided for each patient, including all payments for clinical care for outpatient visits, hospitalizations, prescription drugs, diagnoses, and intervention procedures.

In this study, nine major cancers were considered: lung (ICD-9-CM code: 162), esophagus (ICD-9-CM code: 150), liver (ICD-9-CM code: 155), stomach (ICD-9-CM code: 151), colorectal (ICD-9-CM code: 153-154), oral (ICD-9-CM code: 140-141), nasopharyngeal (ICD-9-CM code: 147), cervical (ICD-9-CM code: 180), and breast (ICD-9-CM code: 174) cancers. In addition, data of a nationwide systematic random sample of 50,481 patients who were older than 17 years and had received PMV for > 21 days (ICD-9-CM code: 518.85) during 1998—2007 were collected and they were followed up until the end of 2007.[10] In order to apply generalized cost-effectiveness analysis,[8] it is necessary to have a comparison group that is not receiving formal medical care over natural course of the disease. As all cancer treatments under internationally established guidelines can be waived from copayment under the current NHI system, it is almost impossible to recruit cancer patients who are not receiving any treatment in Taiwan. We thus assigned 22,344 cancer patients under hospice care in the comparison group to estimate survival, as they only received basic palliative care, and the quality of life (QoL) value for these individuals was assumed to be 0.4 in the analysis.[11]

Survival analysis and extrapolation to estimate life expectancy for different illnesses

All of the above patients were linked to the Taiwan Mortality Registry to obtain their survival functions via the Kaplan—Meier (K—M) estimation method.[12] These were further extrapolated to lifetime based on a semiparametric method using the age- and sex-matched referents