RESEARCH COMMUNICATION

Cost of Care for Lung Cancer in the First Year after Diagnosis in Iran

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Abstract

Objective: The aim of this study was to estimate the cost of lung cancer treatment in the first year after diagnosis in Iran. Materials and Methods: Patients from two referral hospitals providing all lines of treatment to cancer patients in Tehran were sampled. The direct cost included the costs that patients and other payer's (insurance, NGO's, or other source of payment services) paid for the services received since their first confirmed diagnosis of cancer for the duration of one year. Nine items of services were evaluated for each case with exact costs abstracted from patient's files. Using incidence of lung cancer and population figure of the country, total number of lung cancer was estimated. The total and itemized costs were estimated using an average per patients for each service. Results: The average age at diagnosis was around 56 years and majority of cases were male. All patients were insured by major insurance companies. A total of 5,829 cases of lung cancer were estimated to occur in 2010. The average±standard deviation (sd) of duration of hospital stay was 11.9±9.7 days. Not all the patients received all lines of services: 86% received surgery, 36% radiotherapy; and 45% chemotherapy in the first year. Some 14% of cases utilized physiotherapy and 11.5% needed pre-treatment counseling. The grand total cost of treatment for the first year of services since diagnosis was estimated at 11,262,386 US dollars for the whole population of Iran in the year 2010. Among different services provided to the patients, surgery with annual cost of 3,178,725 US dollars constitute 28% of the total cost; radiotherapy and cost of paid for medication with an annual cost of 4,242,244 US dollars accounted for 38% of total costs. With 7.8% of Iranian GDP being consumed in health expenditure, the direct cost of lung cancer for the first year after diagnosis amounted to 4% of this figure. Conclusion: Our study, the first to estimate the direct cost of lung cancer in Iran, indicate how costly lung cancer is to the country. More comprehensive studies are needed to validate our results plus to assess other cost including indirect costs.

Keywords: Lung cancer - Iran - first year of treatment - economic costs

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Introduction

Lung cancer is a leading cause of cancer death in the world with an estimated 1.6 million cases in the year 2008 and constituting close to 13% of total cases of cancer and majority of these cases occurred in developed world (Ferlay et al., 2010). The incidence has been decreasing in last decade in developed world as the prevalence of smoking has diminished due to extensive antismoking campaigns and general population awareness (Parkin et al., 2010). Lung cancer is still a major killer in developing world especially where the prevalence of smoking is high as countries of West Europe, south East Asia and Indian subcontinent (Bray et al., 2002; Pisani et al., 2002). The incidence of lung cancer in Iran is estimated as 10.5 for male 5.1 for female and the incidence has been increasing in recent years as the prevalence smoking has increased (Mosavi-Jarrahi et al., 2004; Mohagheghi et al., 2009). Mortality from lung cancer is the second after stomach cancer with a mortality rate of 5.3 per 100000 population and responsible for close to 33000 years of healthy life lost in Iran (Naghavi and Jafari, 2007) . The major risk factors of lunag cancer are smoking and the smoking prevalence is moderate, close to 24% among general population. The clinical manifestation of lung cancer is extremely demanding and yearly survival rate is less than 30% in different places (Ries, 1994).

Lung cancer is usually treated with surgery, chemotherapy, and/or radiation, and may require other services. The treatment of lung cancer can be defined more precisely by histological type and specific location of the cancer in the lung. The financial burden of lung cancer is devastating to family as well as to the society as general it is considered one the costly diseases among the likes (Meropol and Schulman, 2007). The cost of lung cancer in the United States in the year 2010 has been estimated as

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268 billion of this 102.8 billion for direct and 20.9 billion for indirect costs (American Cancer Society, 2010). The cost of cancer has not been estimated for Iranian patients and no data are available in literature on the cost of lung cancer. The aim of this study was therefore to estimate the initial cost of lung cancer treatment in Iran.

Materials and Methods

From close to 176 hospitals in Tehran, two major public hospitals were selected to collect data on the direct cost of lung cancer. The hospitals were selected based on the fact that they are referral for lung cancer plus they do provide all line of treatment for patients as well as a willingness to collaborate with the investigator. All patients referred to hospitals with diagnosis of lung cancer for the year 2009 were included in the study.

The direct cost included all cost pertaining to each patient from diagnostic, treatment (in patients) and counseling and any other services provided by hospital. The paid amount of money for each item of services either by patient s or insurance or other payers was included. For each item of services, the cost was estimated per patients by averaging the paid amount over number of patients receiving the services. To estimate the total cost for the whole country, the incidence figures from the first report of the Tehran Population based Cancer Registry (a ongoing registry collecting data on the incidence of cancer in 20% of the Iranian population) were used to estimate the total number of lung cancers in the 2010 in Iran (Mohagheghi et al., 2009), for this, the crude rate of lung cancer were applied to total number population. The population of Iran based on sex was extracted from the official site of the Iranian statistical office (Iran Statistical Center, 2011). To express the total cost as percent of gross national product, the fraction of GDP for health sector were obtained and the percent of total cost of lung cancer were expressed as percent of GDP for health sector. The data on cost were based on Iranian Rials but it was converted to US dollars based on the average exchange rate in 2009.

Results

A sample of 99 cases of lung cancer with complete data were studied. The average age at diagnosis was around 56 years and majority for cases were male. All patients were insured by major insuring companies. The average standard deviation duration of hospital stay was 11.9±9.7 with minimum of one day and a maximum of 38 days. Not all patients received all line of services. Just eighty six percents of patients required surgery this figure was 36 percent required radiotherapy and just 45 percents needed chemotherapy in the first year. Fourteen cases (14.5% and 11 cases (11.5) needed the auxiliary services such as physiotherapy and pre-treatment counseling. Among different services given to patient's surgery with annual cost of 3,178,725 US dollars constitute 28% of the total cost and cost of hospitalization accounting for 22.1% of total cost. Radiotherapy and cost of paid for medication account for close to 38% with the amount of 4,242,244 us dollars (table one describe a detailed and itemized cost as well as total cost of for the year 2010). All patients were insured and were using a kind of insurance. Just few cases had no insurance and they were charged to their personal assets. Seven point eight percents of the Iranian GDP is consumed in health sector, the cost of the lung cancer in the first year amounted to 4% of the GDP for health sector.

Discussion

IThe economic burden of cancer is defined by evaluation the direct and indirect costs incurred by patients and society as a whole. The direct costs reflect the value of services for diagnosis, treatment and up to end of life issues. These include the costs of care provided by physicians and other health care professionals, care provided in hospitals and other health care institutions, drugs, laboratory services and research. The indirect costs represent the reduced productivity associated with lost or impaired ability to work because of illness and the loss of economic productivity because of premature death. In our study we measured cost of care for direct cost for a common cancer in Iran. Our study is the first that quantifies the initial costs of lung cancer in Iran. The result of our study indicates how much of the direct cost of lung cancer attributed to major category of treatment regimen, surgery and radiotherapy. Our study showed a high portion of total cost for radiotherapy compared to chemotherapy this observation may be due to the fact that large portion of cost of chemotherapy is spent on the medication and

Table 1. Itemized costs* for the first year of care for lung cancer patients in Iran, 2010

Service Items	Average cost per case	Number requiring services**	Yearly cost	% of total cost
Hospitalization	406.71	5,829	2,370,778	21.1
Pre-operating consultancy	66.87	589	39,371	0.3
Surgery	626.79	5071	3,178,725	28.2
Radiology	55.17	5479	302,281	2.7
Diagnoses	151.16	5,829	881,169	7.8
Drugs	385.04	5,829	2,244,497	19.9
Physiotherapy	278.33	822	228,760	2.0
Chemotherapy	74.1351	257	19,059	0.2
Radiotherapy	996.26	2005	1,997,747	17.7
Total cost			11,262,386	100

*Cost in US dollars; **Total number of cases were estimated based on the rate from the Tehran population based cancer registry incidence estimates for lung cancer and population estimates for the year 2010

just small portion of cost of chemotherapy spent on the nursing and paramedical services of the chemotherapy administration. Studies in other countries indicates drugs used in the treatment of cancer patients account for a high percentage of medical drug expenditures in hospitals and outpatient clinics (Meropol and Schulman, 2007) .

In a literature review about the cost of illness, it was shown that lung cancer is a costly illness, and that hospitalization and treatments account for a large part of direct costs, while indirect costs represent a large part of the total costs (Molinier et al., 2006). The total cost of cancer care in the United States in 2005 was 209.9 billion (US Census Bureau, 2010). Direct medical costs including inpatient and outpatient care, drugs, and devices accounted for $74 billion of this total, $17.5 billion was attributed to indirect morbidity costs, and indirect mortality costs (lost productivity due to premature death) accounted for $11 8.4 billion. The direct cost of lung cancer was 39 891 US dollars for the first year following diagnosis per patients in US in 2002(Warren et al., 2008). In an study in China, The cost for the initial year following diagnosis for lung cancer was 25,648,000 Chinese won and the cost was significantly higher for cost of liver or stomach cancer (Kim et al., 2009). Study of burden of smoking in Vietnam has estimated average direct cost of 8187900 Vietnamese dollars ($VN) per patients (Ross et al., 2007) for lung cancer. While the initial cost of care for lung cancer patient accounts for large portion of total cost (including cost of palliation and progression of disease), in a population based study of 306 patients the total cost of care from diagnosis to death accounted for 42,066 US dollars in USA (Fox et al., 2008).

The economics of cancer is a major burden for any society and this burden worsening as the population demography changes toward older population resulting in higher cancer expenditures in the future for countries with young population such as Iran. Such a transition has already been documented in terms of cost of cancer care in US as the so-called baby boomer population swells the ranks of the US Medicare program from 42.5 million in 2005 to almost 70 million by 2030(US Census Bureau, 2011b).

From stand point of methodology, our study used a direct sampling to estimate the cost of lung cancer. The direct cost estimated using this methodology does not take into consideration that a certain portion of patients use the same treatment or patient care with higher cost by utilizing private patient care. There different methodology and almost no consensus among the health economist which methodology would be preferred. A review of the methodology of cost of cancer care showed that studies adopted significantly different approaches to estimate the costs of lung cancer, reflecting a lack of consensus on the methodology of cost of cancer care studies in the economics of cancer.

In conclusion: our study was the first to estimate the direct cost of lung cancer in Iran. The findings indicate how costly the lung cancer in Iran is. More comprehensive studies needed to validate our results plus to study other cost including indirect costs of cancer care in Iran.

References

American Cancer Society (2010). Cancer facts and figures 2006. http://www.cancer.org/downloads/STT/CAFF2006PWSecured.pdf . .

Bray F, Sankila R, Ferlay J, et al(2002). Estimates of cancer incidence and mortality in Europe in 1995. *Eur J Cancer*, **38**, 99-166.

Ferlay J, Shin H R, Bray F, et al (2010). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*, **127**, 2893-917.

Fox K M, Brooks J M, Kim J (2008). Metastatic non-small cell lung cancer: costs associated with disease progression. *Am J Manag Care*, **14**, 565-71.

Kim SY, Kim SG, Park JH, et al (2009). Costs of initial cancer care and its affecting factors. *J Prev Med Public Health*, **42**, 243-50.

Meropol J, Schulman KA (2007). Cost of cancer care: issues and implications. *J Clin Oncol*, **25**, 180-6.

Mohagheghi MA, Mosavi-Jarrahi A, Malekzadeh R, et al (2009). Cancer incidence in Tehran metropolis: the first report from the Tehran Population-based Cancer Registry, 1998-2001. *Arch Iran Med*, **12**, 15-23.

Molinier L, Combescure C, Chouaid C, et al (2006). Cost of lung cancer: a methodological review. *Pharmacoeconomics*, **24**, 651-659.

Mosavi-Jarrahi A, Mohagheghi M, Yazdizadeh B, et al (2004). Analysis of smoking behaviour among Iranian population: a cohort and period analysis. *Asian Pac J Cancer Prev*, **5**, 66-9.

Naghavi M, Jafari N (2007). Mortality profile for 29 provinces of Iran. No. 5. The Iranian Ministry of Health and Medical Education-Deputy of Health.

Parkin DM, Ferlay J, Curado M P, et al (2010). Fifty years of cancer incidence: CI5 I-IX. *Int J Cancer*, **127**, 2918-27.

Pisani P, Bray F, Parkin DM (2002). Estimates of the world-wide prevalence of cancer for 25 sites in the adult population. *Int J Cancer*, **97**, 72-81.

Ries LA (1994). Influence of extent of disease, histology, and demographic factors on lung cancer survival in the SEER population-based data. *Semin Surg Oncol*, **10**, 21-30.

Ross H, Trung D V, Phu VX (2007). The costs of smoking in Vietnam: the case of inpatient care. *Tob Control*, **16**, 405-9.

Statistical Centre of Iran (2011). http://www.amar.org.ir/default.aspx?tabid=52 . 2011a.

US Census Bureau (2010). ECONOMIC IMPACT OF CANCER. http://www.aacr.org/home/public--media/science-policy--government-affairs/resources-for-policymakers/economic-impact-of-cancer-research.aspx.

US Census Bureau (2011). Interim: Projections by age, sex, race, and Hispanic origin. http://www.census.gov/ipc/www/usinterimproj/ .

Warren JL, Yabroff KR, Meekins A, et al (2008). Evaluation of trends in the cost of initial cancer treatment. *J Natl Cancer Inst*, **100**, 888-97.