RESEARCH COMMUNICATION

First Data On Direct Costs of Lung Cancer Management in Morocco

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Abstract

Background: Lung cancer is the leading cause of cancer morbidity and mortality. Its management has a significant economic impact on society. Despite a high incidence of cancer, so far, there is no national register for this disease in Morocco. The main goal of this report was to estimate the medical costs of lung cancer in our country. Methods: We first estimated the number of annual new cases according to stage of the disease on the basis of the Grand-Casablanca-Region Cancer Registry data. For each sub-group, the protocol of treatment was described taking into account the international guidelines, and an evaluation of individual costs during the first year following diagnosis was made. Extrapolation of the results to the whole country was used to calculate the total annual cost of treatments for lung cancer in Morocco. Results: Overall approximately 3,500 new cases of lung cancer occur each year in the country. Stages I and II account for only 4% of cases, while 96% are diagnosed at locally advanced or metastatic stages III and IV. The total medical cost of lung cancer in Morocco is estimated to be around USD 12 million. This cost represents approximately 1% of the global budget of the Health Department. According to AROME Guidelines, about 86% of the newly diagnosed lung cancer cases needed palliative treatment while 14% required curative intent therapy. The total cost of early and advanced stages lung cancer management during the first year were estimated to be 4,600 and 3,420 USD, respectively. Conclusion: This study provides health decision-makers with a first estimate of costs and the opportunity to achieve the optimal use of available data to estimate the needs of health facilities in Morocco. A substantial proportion of the burden of lung cancer could be prevented through the application of existing cancer control knowledge and by implementing tobacco control programs.

Keywords: Health costs - Morocco - lung cancer - prevention - Mediterranean area

Introduction

Lung cancer has been considered as the most common cancer in the world for several decades. Its incidence increased from 1.2 million to 1.61 million new cases between 2000 and 2008 representing 12.7% of all new cancers (Parkin, 2001). It was the most commonly diagnosed cancer as well as the leading cause of cancer death in males in 2008 globally.

Lung cancer accounts for 13% (1.6 million) of the total cancer cases and 18% (1.4 million) of the deaths attributable to cancer in 2008 (Jemal et al., 2011). It remains a disease with a dismal prognosis, with an average five-year survival of 15% in "Western" countries (Crowell et al., 2007). In the developing countries such as those of the Asia Pacific region, the five-year survival for lung cancer is lower at approximately 9%; largely due to late diagnosis and less effective treatment options and supportive care (Ou et al., 2009).

The majority of the cases now occur in the developing countries (55%). Lung cancer is still the most common cancer in men worldwide (1.1 million cases, 16.5% of the total), with high rates in Central-Eastern and Southern Europe, Northern America and Eastern Asia.

Continents with the highest age-standardized incidence rates for men are North America and Europe, where annual rates are greater than 50 incident cases per 100,000 person-years (GLOBOCAN 2008). Altogether industrialized countries have an incidence rate of 62.6 among men whereas the overall rate in less developed countries combined is 24.1 per 100,000 person-years (Parkin, 1999). Rates are low in sub-Saharan Africa (Jemal et al., 2011), ranging from 2.2 in Western Africa to 29.1 per 100,000 person years in Southern Africa. Northern Africa has an intermediate rate in men of 12.8 per 100,000 person years, although three countries in that region experience incidence rates close to 20 per 100,000 person-years: Algeria, Morocco, and Tunisia (Ferlay et al., 2001)

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In females, lung cancer is the fourth most commonly diagnosed cancer and the second leading cause of cancer death. The highest lung cancer incidence rates are found in North America, Northern Europe, and Australia/New Zealand. Despite their lower prevalence of smoking (less than 4% adult smokers), Chinese females have higher lung cancer rates (21.3 cases per 100,000 females) than those in some European countries such as Germany (16.4) and Italy (11.4), with an adult smoking prevalence of about 20% (Mackay et al., 2006). Unfortunately, most diagnoses occur at later stages of the disease. Factors such as tumor size and location, histology, involvement of nodes, and the spread of cancer to other tissues affect outcome.

Financing cancer treatment is a major challenge for both developed and developing countries. However, developing countries are more vulnerable because of the limitations in their pharmaceutical industries, disparity of means and because of delayed diagnosis. Prevention is considered as one of the main actions that could decrease the health cost and its weight on our society.

The association between smoking and lung cancer is certain; 90% of all lung cancer cases are directly attributed to smoking (Huxley et al., 2007). The observed variations in lung cancer rates and trends across countries or between males and females within each country largely reflect differences in the stage and degree of the tobacco epidemic (Youlden et al., 2008; Bray et al., 2010). Smoking accounts for 80% of the worldwide lung cancer burden in males and at least 50% of the burden in females [Ezzati et al, 2005]. In addition to morbidity and mortality rates, lung cancer also has a significant economic impact on society. With respect to cancer costs, lung cancer accounted for 12.4% of total hospital care costs and 26% of total mortality costs or loss of productivity due to premature death in 1998 in Canada (Demeter et al).

Morocco, a country of the Eastern Mediterranean region, has a population of over thirty million inhabitants and an average per capital income of $1200; the situation in Morocco is as alarming. Smoking prevalence has increased among adults from 17.2 % to 18.5 % between 2000 and 2006. The highest rates for men were found in the age group 30–39 years (42.0%), whereas for women the highest rates were for the age group 20–29 years (4.7%) (Tazi et al., 2003; Nejjari et al., 2009).

In Morocco, there are about 30,000 new cases of cancer each year. These cancers are responsible for 7.2% of death. Cancer is treated in five public centers and six private structures in addition to the cancer department of the military hospital. Cost of cancer management is very high and the situation is all the more worrying that more than two thirds of the population has no medical coverage. To our knowledge, few data are available concerning direct medical cost of lung cancer. The main objective of the present study is to provide an evaluation of the total medical cost of lung cancer due to its frequency.

Materials and Methods

Data collection

The first step was to evaluate the total annual incidence of lung cancer. In the absence of a national registry of cancer, the only source of epidemiological information currently deemed valid on the epidemiology of cancer in Morocco is the Grand-Casablanca-Region Cancer Register (GCRCR) (2004 data). This register is based on a population sample accounting for 10% of the Moroccan population (Registry of tumors in Great Casablanca region, 2004).

The total number of patients suffering from lung cancer washat the rate of lung cancer in Morocco is equivalent to the regional rate provided by the GCRCR. This source is a population-based cancer register, monitoring the frequency of cancer sub- types in the region of Casablanca. Sources of the recovered data were public University teaching Hospital Casablanca (Services of Medicine, Services of Surgery, Central laboratory of Pathological anatomy), private clinics, and private laboratories of Pathology. Data were collected in native format and active method was used to collect cases. Estimation of new cases number in each diagnosis stage was elaborated using National Cancer Prevention and Control Plan Strategic data.

Cost estimation

Estimation of the total cost of lung cancer treatment in Morocco is based on the estimation of individual treatment cost in each stage which covers diagnosis treatment and following up during first year which was evaluated according to international standards [19]. We used clinical recommendations of AROME (Association of Radiotherapy and Oncology of the Mediterranean Area; www.aromecancer.org). It takes into account availability of means and cultural aspects, there were developed for most common cancer sites in countries around the Mediterranean Area.

These guidelines aimed to form the basic level, and oncologists should recognize that it would be inappropriate to treat cancer patients without availability of these requirements. On the other hand they aimed to rationalize cancer care and make better management of the available means so as to treat more patients in a most cost-effective manner. Existing guidelines for optimum care in countries with limited resources proposed by organizations such as the International Atomic Energy Agency (IAEA) (Macbeth et al, 2007) were also taken into account during the preparation of the recommendations for the mediterranean area.

Cost was estimated per unit and whole cycle-set using for each drug the price as indicated by the Agence Nationale de l'Assurance Maladie which gives the average public price (APP) in Moroccan Dirhams (MAD).

This method is an estimation of the direct medical costs incurred by lung cancer patients. It does not include information on elements such as indirect medical costs, pain and suffering, lost time of unpaid caregivers.

Results

Estimation of the incidence of lung cancer in Morocco

In all lung localization combined, 36 cases of cancer were recorded by the GCRCR in 2004, including 1,833 in men and 1,503 in women. The standardized

Table 1. Estimate Number of Annual Lung Cancer New Cases by Diagnosis Stage

Stage	Percentage	N
I	1.4	49
II A	0.7	24
IIB	1.9	67
III A	10.3	362
III B	33.5	1176
IV	52.2	1832
total	100	3510

Table 2. Treatment Cost (stage I, II and III A) During the First Year According to International Guidelines

Diagnosis	Cost (MAD)
Physical examination (pneumologiste)	150
Chest X-ray	150
Liver function tests and liver US	250
Bone scan	700
Treatment	
Surgical resection	8320
Postoperative treatment	
Platinum	1000
RT	24000
Follow up (History/physical examination)	600
Total	35170

Table 3. Treatment Cost (III B and IV) During the First Year According to International Guideline

Diagnosis	Cost (MAD)
Physical examination (pneumologiste)	150
Chest X-ray	150
Liver function tests and liver US	250
Bone scan	700
Treatment	
ChemoT	1000
RT (55Gry)	24000
Follow up (History/physical examination)	600
Total	26250

Table 4. Estimation of Total Cost of Lung Cancer According to Diagnosis Stage

Stage	Number of cases	Cost per unit (USD)	Total cost
I, II, and IIIA	502	4600	1.716.840
IIIB and IV	3008	3420	10.287.360
Total	3510	****	12.004.200

26,250 MAD (USD 3420). Table 4 shows total medical direct cost of new diagnosed case of lung cancer (all stage), it was by multiplication of unit cost by number of annually new case, and it is estimated as around USD 12 Millions.

Discussion

For our knowledge, this is the first study tha provides estimates for the direct medical cost of lung cancer in Morocco. According to international recommendations, Moroccan health authorities need to devote around USD 12 million every year in order to treat new lung cancer cases. This cost represents around 1% of the global budget of the Health Department (MAD 9.8 billion or USD 1.274 billion). Unfortunately, only one-third of the Moroccan population have healthcare insurance whereas for each patient treated with chemotherapy alone costs 1.1 times the annual minimum income (MAD 23.710 or USD 3,080). In the absence of accurate data, the estimates yield from this study will of great importance to help decision makers in process looking to alleviate the economic burden in general and the cost of lung cancer in particular. Data shows that 80% of the cases are diagnosed at late stages III and IV. Total direct medical cost is estimated as USD 12 millions and more than 80% of the cost is imputed to radiotherapy.

Our study presents some limitations. First, estimates of annual lung cancer incidence by extrapolating the data from the region of Casablanca to the whole country assumes that this regional incidence is the average incidence for the whole country. Such an assumption could be considered as valid under two conditions: (i) first, either lung cancer incidence is nearly uniform through all regions or there is a compensating effect between regions.

incidence was slightly higher in female (104.2 for 100 000 females/year versus 100.3 for 100 000 males/year). Excluding the unspecified «other cancers», the most frequent cancers recorded in the Metropolitan Casablanca Region in 2004 were the breast (36.1%) and cervix (12.8%) cancers for females, while for males these were lung (23,8 %) and prostate (8,3%) cancers. The total number of lung cancer cases was 389 (358 among men and 31 among women) representing 11, 7% of total new cases of cancer.

The extrapolation of these results to the Moroccan population leads to a global standardized incidence (males + females) of 101.7 new cases for 100,000 inhabitants per year. This corresponds to about 30,000 new cases of cancers (all localisations) in Morocco each year, and 3510 new case of lung cancer. At diagnosis, stages I or II represents only in 4% of cases, while 96% of the cases are diagnosed at the stages III and IV (Pentheroudakis et al, 2008). Table 1 shows number of new cases in each diagnosis stage.

Estimation of direct medical cost of lung cancer (individual treatment (at the exchange rate MAD 10 = USD 1.3)

In order to evaluate the individual cost of treatment, the following information were needed: 1) the unit price of different drugs and health care service used of lung cancer, 2) recommendation concerning treatment, diagnosis and following up during the first year. According to Guidelines, minimal requirements and standard of cancer care around the Mediterranean Area, 14.3% (502 cases) of all newly diagnosed lung cancers (stage I, II and IIIA) needed surgical resection, chemotherapy and radiotherapy, while 85.7% (3008 cases which represent stage IIIb and IV) needed palliative treatment.

Table 2 summarizes total cost of diagnosis, treatment, and follow up on the first year of stage II, II and IIIA. It's estimated as 35,364 MAD (USD 4600). Table 3 shows the same cost of stage III B and IV which is estimated as

months prior to death and Disability Adjusted Life Years (DALYs). Moreover, we were not able to discriminate if such hospital admissions required general ward care or more intensive care. We may have underestimated the cost of these admissions.

The purposes of clinical practice guidelines are to improve the quality of patients care (namely survival and quality of life) and assist clinical decisions by rationalizing the use of available resources and prioritizing research goals (Smith and Hilnner, 2001; McCarthy et al., 2008). Guidelines have proven to be efficient in patients' outcomes, at least in industrialized countries and tools to standardize guidelines have been developed (National Institute for Health Clinical Excellence, 2007).

Comparison of treatment cost in different countries shows that costs in Morocco are less than western countries but it is still expensive compared to income (Shafey et al., 2009). According to ALSCL study (non published data), direct medical cost for lung cancer is around 31 000 MAD per case.

The results of impact studies on the costs related to cancer care are sufficient proof of the heavy burden incurred by households as well as the severe social and economic repercussions of a cancer disease; up to 90% of the cost of certain cancers are incurred by patients. The result being that cancer contributes inevitably to making its patients even poorer.

Lung cancer cost studies have also been performed internationally in the United Kingdom (Oliver at al., 2001), Australia and the United States (Esnaola et al., 2002). International review on the economic analysis of lung cancer shows that, on a macro scale, comparisons among countries is difficult due to "differences in medical practices and health care systems" (Vergnenegre et al., 2001). They also comment on the need for continued 'microeconomic analysis' due to the ongoing advances in therapeutic interventions and associated technology needs.

Governments must take public concerns about cancer seriously (Rawaf et al., 2006). Collecting sound data and aligning cancer registries with international standards is an urgent public health demand. Most of the worldwide burden of lung cancer could be avoided by applying proven tobacco control interventions that include raising the price of cigarettes and other tobacco products, banning smoking in public places, the restriction of advertising of tobacco products, counter advertising, and treating tobacco dependence (Shafey et al., 2009). For example, a 10% increase in cigarette prices has been shown to reduce cigarette consumption by 3% to 5% (CDC, 2007). Initiate operational research on the cost/benefit ratio of prevention measures;

In 2003, the WHO established the Framework Convention on Tobacco Control to enable international coordinated efforts to curb the tobacco epidemic. Morocco is among the few countries that have yet to ratify the treaty.

In conclusion, The burden of lung cancer is a major problem for both developed and developing countries; but citizens of developing countries are more vulnerable because of delayed diagnosis and lack of funds that allow for appropriate treatment, especially for patients with very limited income. The present study illustrates for the first

time direct medical cost of lung cancer in Morocco. It will add to costing data available to heath care researchers, especially in the field of oncology health economics.

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