

Better understanding of the health care costs of lung cancer and the implications

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Cost-of-illness data are often considered to be a useful indicator to underline the relevance of a disease or a research field. Yet, cost analyses may be useful beyond that. In the field of lung cancer, this editorial will consider the contribution of cost to describing the burden of disease, and to analyzing the economic aspects of prevention and treatment. Building upon recent analyses, the situation in Germany will be referred to, although also related to an international perspective.

Burden of lung cancer

The burden of lung cancer can be well described by mortality measures. In 2013, the Global Burden of Disease Study reported 1.64 million deaths from lung cancer worldwide, which accounts for 3% of all causes of death and represents a 56% increase since 1990; in 2013, this study found lung cancer to be the second most important cause of death in terms of years of life lost in countries with high per capita income, including Germany [1]. Owing to the high relative risks of smoking [2], trends in lung cancer mortality can be expected to closely reflect, with delay, the epidemic of smoking. A recent international comparison since 1950 showed that, in several countries, lung cancer mortality had already peaked for males by the last quarter of the 20th century, whereas for females in Europe, a continuing increase was noted [3]. In Germany, age-standardized mortality from lung cancer has declined by a quarter for males from 1998 to 2012. In contrast, it has increased for females by 41.2%, accounting for about a third of total lung cancer mortality by 2012 [4] (own calculations). On average, one individual is diagnosed with lung cancer in Germany about every 10 minutes, and every 12 minutes, one individual dies from it.

Given the wide variety of health care systems, the health care cost of lung cancer has not yet been defined at the global level. At regional and at country level, estimates are available: the European Lung White book calculated these costs to amount to 3.35 bn Euros in European countries in 2011 [5]. However, the methods underlying this figure are not transparent. Based on a national cost-of-illness framework in Germany, the reported health

care cost of lung cancer amounted to 1.46 bn. Euros in 2008 [6]. Unfortunately, this figure hardly reflects today's epidemiological and medical situation. Further, this cost-of-illness framework crudely allocates cost to diseases by single, highly aggregated diagnostic information. Thus, it may not fully capture the cost impact of lung cancer, as this would require valid diagnostic information at all levels of the health care system, and yet is lacking in methods to appropriately account for multi-morbidity. Moreover, cost-of-illness estimates are often based on prevalence, not on incidence. In the former approach, shorter survival is accompanied by lower prevalence than longer survival. In consequence, total costs of care tend to be lower in diseases with shorter survival—such as in lung cancer.

In order to reduce the substantial burden of lung cancer, new approaches to prevention and treatment are needed. Evidence-based management requires these approaches to be effective and cost-effective.

Prevention and early detection

In the economic evaluation of strategies to prevent lung cancer, treatment costs of incident lung cancer are a key parameter. For example, smoking cessation models require this type of data, as do radon prevention models, which may even aim to optimize control of both regional radon emission and smoking behavior [7]. In the case of lung cancer, once it has developed, early detection is paramount to reduce mortality: patients at an operable stage of the disease have a substantially improved survival prognosis [8].

Early detection may be achieved by lung cancer screening. Following the landmark results of the U.S. National Lung Cancer Screening Trial [9], an international discussion on implementing low-dose computed tomography lung cancer screening has emerged—including, among others, in Germany [10]. Important issues in this approach include screening strategy, target population, and dealing with the substantial likelihood of false-positive screening results and their consequences. Deciding on screening and choosing the appropriate strategy may be significantly supported by economic evidence on the strategies at stake. Therefore, cost estimates of the care available for lung cancer at different stages are needed. A systematic review of the cost-effectiveness of lung cancer screening has already revealed a number of studies, but has also reported wide variation in results and significant gaps regarding reference to European health systems [11]. Assessments adequately reflecting the design of screening programs and their target groups, and the relevant country context, are still needed. Concerning fiscal implications but not health, a recent study analyzed the decision by the U.S. Centers for Medicare and Medicaid Services to introduce screening for enrollees aged 55–77 years with a smoking history of more than

30 pack–years. This study expects lung cancer diagnosis to increase and to shift to earlier stages of the disease, and for expenditure to increase as well [12]. Considering expenditure increases, another study suggested incorporating the cost of lung cancer screening into the price of cigarettes [13], thus touching upon the generally difficult question of accountability.

Treatment

In lung cancer treatment, several novel drugs have emerged during the last decade, employing biomolecular and targeted approaches. For example, four new drugs approved for lung cancer treatment have entered German regulation of coverage and reimbursement since 2011 [14]. Many jurisdictions use patient benefit as a primary criterion for deciding on new drugs; some also consider cost-effectiveness and require cost data. Critical discussion about innovative oncology drugs has raised topics such as extent of benefit achieved, complexity of treatment, and high costs [15]. Next to regulatory decisions, factors such as physician and patient perception may also influence the diffusion of new drugs. Studies analyzing treatment costs in claims data are thus likely to incorporate novel technology with some delay compared with first market access. Another factor that has been shown to increase cost is failure of initial treatment [16]. Reducing this failure, eventually by better targeted treatment, may thus contribute to cost-efficiency.

Past changes in epidemiology and treatment patterns have been incorporated in a recent trend analysis of acute hospital care for lung diseases, including lung cancer. For Germany, this analysis expects a 13% cost decrease in the period from 2013 to 2018. Important determinants of this trend include an even stronger decline in length of stay and in number of cases, whereas costs per case are expected to increase. The decline in the number of inpatient lung cancer cases contrasts with the increase expected in the number of admissions to acute hospital care in general [17]. Given that lung cancer incidence is still on the rise, a factor contributing to this divergence in trends may be the strong increase observed in the number of outpatient oncologists in Germany [18], thus underlining the role of care structures in cost analyses.

Another aspect relevant to the cost of lung cancer care is typical patient careers. Recent studies found that 20–28% of patients first diagnosed with lung cancer did not receive cancer-specific treatment such as radiotherapy, chemotherapy, or surgery. This may be caused by diagnosis at an already too advanced stage of disease, or patients' own requests to avoid treatment with unacceptable consequences [8,19]. These findings indicate an urgent need to further improve health care options for lung cancer patients, including supportive and palliative care [20].

Perspectives

Analyzing the cost of lung cancer is clearly relevant beyond estimating disease burden. It is needed to better understand, evaluate, and improve primary prevention, screening, and treatment. Cost evidence must be based on thorough methodology, and it needs to be country-specific, reflecting both epidemiology and health care systems. The analysis of lung cancer costs may be further improved. One option is to better detail medical variables in claims data, e.g., by coding type of lung cancer and tumor stage at initial diagnosis. Further, cost impacts need to be analyzed in a context-specific way for primary prevention of lung cancer, which remains a major topic in some population groups, for the hot topic of secondary prevention strategies, and for novel treatment options. Linked to clinical and population-based intervention studies, future cost analyses may become more relevant to clinicians and to health care managers, and help to promote strategies to better cope with lung cancer.

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