



Original Research

# The cost and burden of cancer in the European Union 1995–2014



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Received 23 June 2016; accepted 25 June 2016

Available online 31 August 2016

## KEYWORDS

National expenditures on cancer;  
Direct costs;  
Indirect costs;  
EU;  
Cost of cancer drugs

**Abstract** *Background:* There is an intense debate about the cost of cancer and the value of new treatments. However, there is limited data on the cost of cancer in the European Union (EU) and how costs relate to the burden of disease. This paper presents new estimates on the development of the cost of cancer in the EU 1995–2014, with a focus on the major cost components: total health expenditure, cancer drugs, and production loss due to premature mortality.

*Methods:* Data on overall health expenditure were combined with national disease estimates to derive cancer-specific health expenditure. Data on drug sales were obtained from IMS Health, and epidemiological data were used to calculate life years lost due to cancer.

*Findings:* Health expenditure on cancer increased continuously from €35.7 billion in 1995 to €83.2 billion in 2014 in the EU and spending on cancer drugs from €7.6 billion in 2005 to €19.1 billion in 2014 (current prices). Yet the share of total health expenditure devoted to cancer was mostly constant (around 6 per cent). While expenditures on cancer drugs increased in both absolute and relative terms, other expenditures were stable or decreased, despite increases in cancer incidence driven by a growing and ageing population. Reductions in cancer mortality during working age resulted in decreasing production loss due to premature mortality.

*Interpretation:* Health spending on cancer as a share of total health expenditure is rather low and stable despite the growing incidence and relative burden of cancer. Problems to reallocate funding in health care systems under economic pressure may be one explanation and shifting costs from inpatient to ambulatory care another.

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## 1. Introduction

International comparative studies of the cost of cancer are rare. In particular, studies describing the development of costs over time are lacking. This paper provides estimates for the cost of cancer and the development of key cost components in the countries of the European Union (EU) for the period 1995–2014. Studies of the cost development over time can provide important new information about how changes in the burden of the disease and new treatment approaches are reflected in the cost of cancer. Such information is important for policy decisions on both the national and European level. We thus relate our findings on costs to the development of the health burden of cancer and discuss implications of our findings.

## 2. Methodology and data

A large number of different data sources have been used to estimate the development of the cost of cancer in the EU and its 28 member states between 1995 and 2014. Cancer is defined according to ICD-10 C00-D48, that is, neoplasms, in the calculation of health expenditure on cancer and according to ICD-10 C00-97, that is, malignant neoplasms, in the calculation of production loss due to premature mortality and the epidemiological development. Details of data and methodology are provided in a recently published report [1].

Expenditures on cancer that are attributable to the health care system were calculated in a top-down manner, a method that has been used previously by Jönsson and Wilking [2,3]. The starting point was a country's gross domestic product (GDP) based on data from Eurostat [4,5]. GDP was multiplied with the share of total expenditure on health of GDP based on data from the World Health Organisation (WHO) [6]. To determine health expenditure on cancer, total expenditure on health was multiplied with an estimate of the share of cancer-specific health expenditure for each country.

The key measure in this estimation is the cancer-specific share of total expenditure on health. In the absence of disease-specific health accounts in most countries, country-specific data on health expenditure on cancer were gathered from reports and studies from the WHO, the Organisation for Economic Co-operation and Development, national ministries of health, national statistical offices, academic research organisations, national cancer societies, as well as studies in peer-reviewed journals. National estimates for 17 countries could be obtained. For the remaining 11 countries, an estimate was imputed based on geographical proximity and similarity in GDP per capita.

Data on cancer drugs (ATC code L1, L2 and four agents from L4 (belimumab, lenalidomide, pomalidomide, and thalidomide)) are based on country-specific sales data obtained from the IMS Health MIDAS database. These sales data are based on ex-manufacturer prices, which do not represent final sales prices, since drugs are granted (secret) discounts in most health systems. The data cover the years 2005–2014 and comprise all drugs sold to hospitals and retail. For 1995, data from a previous report were included for reference [2].

Using the human-capital method, production loss due to premature mortality was calculated based on age-specific cancer deaths from the International Agency for Research on Cancer WHO mortality database for each country [7]. Deaths were assumed to occur in the middle of the 5-year age intervals. Working age was defined to stretch from age 15 to 64 years. Years of potential life lost during working age were multiplied with gender-specific mean annual earnings from employment (referring to year 2010 but adjusted to 2014 prices) and adjusted for year- and gender-specific employment rates in the age group 15–64 years [8,9]. Future earnings were discounted with a 3.5 per cent annual discount rate, and a zero real growth rate in future earnings was assumed.

The results are presented in euros. Cost estimates for a single year are presented using both current exchange rates and exchange rates adjusted for price differentials between countries (purchasing power parities [PPP]) since both are relevant for the interpretation of the results. Cost estimates over time are presented in both current prices and constant prices to take into account the effect of price inflation and thereby separate the contribution of price and volume [10].

## 3. Results

### 3.1. Incidence, mortality, and the burden of cancer

The cost of cancer and its development over time is partly a reflection of the development in cancer incidence and cancer mortality. For instance, rising incidence increases the expenditures for diagnostics and treatment, whereas declining mortality in patients in working age reduces production loss.

Although cancer is an ageing-associated disease, it affects people in all ages; see Fig. 1. During childhood, adolescence and up to the age of 40 years cancer is relatively uncommon. Above that age, it becomes increasingly more common. What seems like a levelling off around the age of 65 years is a consequence of a lower number of people at that age. One third of all new cases were diagnosed in people aged 75 years or older in the EU in 2012, and one half of all cancer deaths occurred in this age group [11,12].

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