**ECONOMIC BURDEN OF MALIGNANT BLOOD DISORDERS ACROSS EUROPE:
A POPULATION-BASED COST ANALYSIS**

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Summary

Background: Malignant blood disorders are a leading contributor to cancer incidence and mortality across Europe. Despite their burden, no study has assessed the economic effect of blood cancers in Europe. We aimed to assess the economic burden of malignant blood disorders across the 28 countries in the European Union (EU), Iceland, Norway, and Switzerland.

Methods: Malignant blood disorder-related costs were estimated for 28 EU countries, Iceland, Norway, and Switzerland for 2012. Country-specific costs were estimated with aggregate data on morbidity, mortality, and health-care resource use obtained from international and national sources. Health-care costs were estimated from expenditure on primary, outpatient, emergency, inpatient care, and drugs. Costs of informal care and productivity losses due to morbidity and early death were also included. For countries in the EU, malignant blood disorders were compared with the economic burden of overall cancer.

Findings: Malignant blood disorders cost the 31 European countries €12 billion in 2012. Health-care cost €7.3 billion (62% of total costs), productivity losses cost €3.6 billion (30%), and informal care cost €1 billion (8%). For the EU countries, malignant blood disorders cost €6.8 billion (12%) of the total health-care expenditure on cancer (€57 billion), with this proportion being second only to breast cancer. In terms of total cancer costs in the EU (€143 billion), malignant blood disorders cost €12 billion (8%).

Interpretation: Malignant blood disorders represent a leading cause of death, health-care service use, and costs, not only to European health-care systems, but to society overall. Our results add to essential public health knowledge needed for effective national cancer-control planning and priorities for public research funding.

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Introduction

Haematological cancers such as Hodgkin's and non-Hodgkin lymphoma, leukaemia, and multiple myeloma are a major health burden.¹ In Europe (the 28 member countries of the European Union [EU], Iceland, Norway, and Switzerland), these four cancers accounted for more than 190 000 (7%) of the nearly 3 million cancer diagnoses made in 2012, and 98 000 (7%) of the 1.3 million cancer-related deaths across Europe.² In 2009, the costs of cancer to the EU were estimated at €126 billion, when health-care costs, informal-care costs, and productivity losses were taken into account.³ Although the study also quantified the costs for a number of cancers individually, it did not assess the costs of malignant blood disorders, or the proportion of total cancer costs that could be attributable to such cancers. The costs to the health-care service of malignant blood disorders have been assessed in individual European countries, such as France, Germany, the Netherlands, and the Nordic countries.⁴⁻⁷ However, the whole economic burden of these disorders, including health-care and informal care costs and losses due to premature mortality or absence from work, have not been comprehensively assessed across Europe. This intelligence is essential for national cancer-control planning. Therefore, the objective of this study was to assess the economic burden of malignant blood disorders across the 28 countries of the EU, Iceland, Norway, and Switzerland for the most recent year for which data were available (2012). Another objective of our study was to assess the proportion of the total costs of cancer (which were estimated for 2012 in the EU⁸) attributable to malignant blood disorders.

Methods

Analysis framework and data sources

Malignant blood disorders were defined by the WHO International Classification of Diseases, 10th revision (ICD-10), codes C81–96 (malignant neoplasms, stated or presumed to be primary, of lymphoid, haematopoietic, and related tissue) and D47 (other neoplasms of uncertain or unknown behaviour of lymphoid, haematopoietic, and related tissue). We used the same methodological framework to obtain data for, and value malignant blood disorders-related resource use in, 31 European countries, comprising 28 EU member states, Iceland, Norway, and Switzerland. An annual time frame was adopted whereby resource use attributable to malignant blood disorders within the most recent year for which data were available were measured, irrespective of disease onset. Costs were converted to 2012 prices⁹ and national currencies were converted to euros using 2012 exchange rates.¹⁰ To allow comparisons of costs between countries, we also adjusted for cost of living using the purchasing power parity method.¹¹ International and national sources were consulted for country-specific aggregate data, including WHO, the Organisation for Economic Co-operation and Development, the Statistical Office of the European Communities (EUROSTAT), and national ministries of health and statistical institutes (see appendix pp 2–9 for methods and sources consulted). Data sources were qualified in terms of data availability using a grading system of A* (national disease-specific data), A (national cancer-specific data available), B (sample cancer-specific data), C (national data but not cancer-specific), and D (no national data available). For example, inpatient care was graded A* in all but five countries (Estonia [D], Greece [A], Italy [A], Netherlands [A], and Portugal [A]). When data were not obtained from these sources, we consulted peer-reviewed published studies or national reports from governmental or professional bodies. If no national data were found, extrapolations were done from similar countries (appendix pp 2–9). A country was judged to be similar if it had similar health-care expenditure per person, life expectancy, and geographical location.

Health-care expenditure

Five categories of malignant blood disorders-related health-care service were included: primary care, accident and emergency (A&E) care, hospital inpatient care, outpatient care, and drugs (appendix pp 3–6). For eight countries, national data were missing (grade D level of evidence) for A&E attendance (Croatia, Czech Republic, Greece, Iceland, Lithuania, Luxembourg, Slovenia, and Sweden) and one country was missing data for hospital inpatient stay (Estonia). Missing all-cause A&E attendance and inpatient days were estimated using attendance rates from similar countries and applying these to the population size of the missing countries (appendix pp 3, 4). Owing to the absence of disease-specific pharmaceutical expenditure in Europe, we obtained pharmaceutical expenditure for the treatment of all cancers (Anatomical Therapeutic Chemical codes L1 and L2).³ Expenditure levels, which were available for the year 2009, were updated to 2012 levels using a 4.6% annual growth in cancer-related pharmaceutical expenditure.¹² In the absence of European-level data, the proportion of cancer-related pharmaceutical expenditure due to malignant blood disorders (14%) was estimated based on an average from reports from the Netherlands⁴ (19%) and Germany (8%)⁵ and applied to the remaining countries. Country-specific population and prevalence estimates were obtained from EUROSTAT and International Agency for Research on Cancer (IARC), respectively,^{2, 13} which allowed us to estimate health-care costs per capita and per prevalent case of malignant blood disorders.

Informal care costs

Informal care costs were equivalent to the opportunity cost of unpaid care (i.e., the time [work or leisure] that carers forgo), valued in monetary terms, to provide unpaid care for relatives with cancer. We used country-specific data from IARC2 to estimate the prevalence of malignant blood disorders and allocate the hours of informal care needed by patients with cancer who require care for malignant blood disorders (see appendix p 6)

reported in the Survey of Health, Ageing and Retirement in Europe (SHARE).¹⁴ SHARE is a multidisciplinary and cross-national panel database of micro data for health, socio-economic status, and social and family networks of approximately 123 000 individuals across 20 European countries.¹⁴ We used waves 2 and 4 of the SHARE survey, which collected data on more than 30 000 individuals resident in 17 EU countries in 2006 and 2010. For the remaining 14 countries, we estimated the hours of informal care by combining data from similar countries in waves 2 and 4 (appendix p 6).

Productivity losses

Productivity costs included the foregone earnings related to malignant blood disorders' attributable mortality and morbidity and were estimated using the number of disease-related deaths,¹⁵ national annual earnings,¹⁶ and employment rates.¹⁷ Future earnings lost due to mortality were discounted to present values using a 3.5% annual rate (i.e., the value society attaches to present as opposed to future costs).¹⁸ Costs due to disease-related morbidity comprised both the costs associated with individuals being declared incapacitated or disabled because of malignant blood disorders (permanent absence) and the costs due to individuals taking sickness leave for a defined time period (temporary absence; appendix p 8). Costs were estimated by multiplying the total working time lost due to malignant blood disorders by mean earnings.¹⁶ Furthermore, we used the friction period approach¹⁹ whereby only the first 90 days of work absence were counted, because absent workers are likely to be replaced. All health and non-health-care resource use was valued using country-specific unit costs (appendix pp 10, 11, 22–30).

Statistical analysis

The heterogeneity across countries in health-care expenditure per prevalent case was examined using ordinary least-squares univariate regression analyses conditional on national income (per capita), health-care expenditure (per capita), cancer incidence (crude), cancer mortality (crude rate), and mortality to incidence ratio. An association was deemed significant if its p value was less than 0.05. All regression analyses were done using Stata (version 14.1). We estimated the effects on the total costs of malignant blood disorders of changes in health-care resource use (all categories) and earnings (men and women) across all countries (adopting a sensitivity range of +20% to –20%), proportion of cancer-related pharmaceutical expenditure due to malignant blood disorders (adopting a sensitivity range of 8% to 19%), discount rate for productivity losses due to early mortality (adopting 10%, 3.5%, and 0% rates), and adoption of no friction period for costs due to cancer-related morbidity.

We used the same method to estimate the costs of malignant blood disorders as that used to assess the overall costs of cancer (ICD-10 C00–97) in 2012 for the 28 countries in the EU.⁸ Adopting the Leal and colleagues method⁸ allowed us to assess the proportion of total cancer care costs that were attributable to malignant blood disorders for EU countries. To make the results comparable, we only included those costs that were attributable to diseases coded under ICD-10 C81–96 (i.e., we excluded the costs attributable to diseases under ICD-10 D47). However, because of the paucity of data, we had to assume that all pharmaceutical expenditure for malignant blood disorders was due to diseases under ICD-10 C81–96 and that patients with diseases under ICD-10 D47 required no informal care. We also compared the proportion of overall cancer expenditure attributable to malignant blood disorders with that attributable to bladder,⁸ breast,³ colorectal,³ lung,³ and prostate³ cancers, for which we also adopted the Leal and colleagues⁸ method. Finally, we ranked each country per cancer site in terms of health-care costs and total costs per capita.

Role of the funding source

The sponsor of the study, the European Hematology Association (EHA), is the European society of medical professionals for haematology. EHA commissioned the University of Oxford to do an independent study of the costs of blood disorders. EHA had no role in study design, data collection, data analysis, and data interpretation. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Malignant blood disorders cost the 28 EU countries, Iceland, Norway, and Switzerland €12 billion in 2012 (table 1). The five most populous countries (France, Germany, Italy, Spain, and the UK) accounted for €8 billion (67% of all costs). For the 28 EU countries alone, the total costs of malignant blood disorders were €11 billion (95% of all costs). Malignant blood disorders cost the health-care systems of the 28 EU countries, Iceland, Norway, and Switzerland €7 billion in 2012 (table 1), representing 62% of the total economic burden of malignant disorders. Inpatient care was the major cost component of health-care expenditure in malignant blood disorders, accounting for €4 billion (54%) of health-care costs, followed by pharmaceutical expenditure at €2 billion (28% of total costs). When averaged across the population of the 31 European countries, the health-care costs of malignant blood disorders were equivalent to €141 per every ten citizens in these countries (figure 1, appendix p 12). These per capita costs varied widely between countries, with a 12-time difference between the lowest (Lithuania, €25 for every ten citizens) and highest (Norway, €303 for every ten citizens) unadjusted cost per capita. Health-care costs were €15,126 per prevalent case (€14,674 in the 28 EU countries alone), but these also varied considerably between countries, with a ten-time difference between the lowest (Lithuania, €3,307) and highest (Greece, €34,514; figure 2, appendix p 12) spender. The average inpatient days per prevalent case was 14 days, but this varied considerably between countries, with a six-time difference between the countries with the lowest

(France and Netherlands, 8 days) and the highest (Greece, 48 days) number of inpatient days (appendix p 15). The univariate analysis showed a strong positive association between health-care costs per prevalent case and national income ($p < 0.0001$) and national health-care expenditure ($p < 0.0001$; appendix pp 18–19), but no other significant associations were identified (appendix p20).

Informal care accounted for 90 million h across the 28 EU countries, Iceland, Norway, and Switzerland, with a cost of €979 million (8% of total costs, table 1). Approximately 90,000 working years were lost due to mortality, which were valued at €2 billion (16% of total costs). We estimated that 12 million working days were lost in 2012 because of disease-related morbidity, which, when adjusted using the friction period, accounted for €2 billion (14% of the total economic burden).

Sensitivity analysis showed that not using the friction period to adjust morbidity losses had the biggest effect on total malignant blood disorder costs (i.e., a 13% increase in total costs). A 20% variation in health-care resource use had the biggest effect on total malignant blood disorder costs (13% change), with the resulting total costs varying between €10.82 billion and €12.94 billion (appendix p 21). The 20% variation in earnings resulted in an 8% change on total disease-related costs, with these varying between €10.94 billion and €12.79 billion.

After excluding the costs attributable to diseases under ICD-10 D47 (€332 million), the total economic burden of malignant blood disorders in the 28 EU countries alone was estimated at €11 billion in 2012 (appendix p 13). In the same year, the overall costs for cancer in the 28 EU countries were €143 billion. Therefore, malignant blood disorders accounted for 8% of total cancer costs for the 28 EU countries (table 2). The countries with the highest proportion of total cancer costs due to malignant blood disorders, representing more than 11% of all total cancer costs, were Croatia, Cyprus, Greece, and Slovenia (appendix p 14). The health-care expenditure of malignant blood disorders in the 28 EU countries alone was €7 billion, with malignant blood disorders representing 12% of the €57 billion cancer health-care costs in the 28 EU countries (table 2). This proportion was second only to breast cancer, which accounted for 13% of cancer health-care costs (table 3). In the

28 EU countries alone, the average inpatient days per prevalent case for malignant blood disorders was 14 days compared with 8 days for all cancers (appendix p 15). In terms of total cancer costs, lung (15%), breast (12%), and colorectal (10%) cancers accounted for a higher proportion of cancer costs than did malignant blood disorders. Adjusting for price differentials, we found the ranking of countries in terms of health-care costs and total costs per capita to vary considerably across cancer sites (appendix pp 16–17). For example, Greece accounted for the highest adjusted health-care expenditure per capita for malignant disorders, but was ranked 15th for colorectal cancer.

Discussion

To our knowledge, our study is the first to provide cost estimates for malignant blood disorders in 31 European countries using the same methodological framework for each country. We estimated the total costs of malignant blood disorders to be €12 billion in 2012 to the 28 EU countries, Iceland, Norway, and Switzerland. We also identified large variation in total costs across the 31 European countries. For example, the total costs were highest in countries with higher than average reported resource use; Croatia, Greece, and Slovenia reported disease-related inpatient days per 1000 of the population above the overall average of 13 days, with Greece and Slovenia both reporting the highest overall at 37 days per 1000 population. Croatia also had one of the highest proportions of working years lost for men (0.37 per 1000), which was three-times higher than the average across the 31 countries (0.12 per 1000).

The reasons for the health-care cost variation warrant further research. However, it might reflect the absence of implementation of accepted models of care and patients being kept in hospital for far longer than expected. In terms of health-care costs per prevalent case, malignant blood disorders cost the 28 EU countries alone €14,674 (€15,126 in the 31 countries) in 2012, which was almost two-times higher than the average expenditure across all sites of cancer (€7,929 in the 28 EU countries).⁸

Similarly, in the USA, cancer costs for lymphoma and leukaemia per prevalent case were two-times higher than for all sites (\$19,490 compared with \$9,045, respectively).²⁰

In the Nordic countries, acute leukaemia, lung cancer, and non-Hodgkin lymphoma had the highest care cost per prevalent cancer.⁷ Health-care costs per prevalent case are higher for malignant blood disorders because of higher and more frequent health-care resource use, particularly higher than average length of stay compared with other cancers.⁷ For example, in our study we estimated average inpatient bed days per prevalent case over the 28 EU countries for malignant blood disorders at 14 days compared with 8 days for all cancers, consistent across all 28 countries.⁸

Furthermore, most malignant blood disorders are now treated with complex, long-term regimens, including bone-marrow transplants, complex multidrug chemotherapy, and radiotherapy, and extensive inpatient diagnostic and prognostic procedures for pathology and imaging are needed.

This treatment approach leads to recurrent inpatient and outpatient stays as well as the use of more chemotherapy relative to other cancers.^{21, 22} Nonetheless, the average health-care cost per prevalent case hides a substantial regional variation in expenditure, even after adjusting for price differentials.

For example, we found a difference of approximately €33,000 in health-care expenditure per prevalent case between the country with the lowest costs (Lithuania) and the one with the highest costs (Greece) after adjusting for price differentials. These differences capture the substantial variation in health-care activity levels, treatment pathways, and unit costs across European countries. For example, in our study, inpatient days per prevalent case varied markedly from 8 days (France) to 48 days (Greece), and the average unit cost per inpatient day across all countries was €510 (95% CI 408–612, range 67–1,487) after adjusting for price differentials. Countries with similar levels of wealth also reported varying health expenditure for malignant blood disorders. For example, Belgium and Finland are similar in national income per capita, but Finland was estimated to have considerably higher health-care costs per prevalent case (€18,014) costs than Belgium (€9,596).

Furthermore, although national income was a strong predictor of health-care expenditure on malignant blood disorders per prevalent case, we found no significant association with mortality, incidence, or mortality-to-incidence ratio. However, European health-care systems are very heterogeneous in their configuration and finance mechanisms, which might partly explain the differences in health-care expenditure. For example, in some countries hospitals are paid per day (e.g., Cyprus, Greece, and non-acute inpatient care in Slovenia), which provides incentives to maintain a high level of bed occupancy and extend length of stay compared with countries where the reimbursement is prospective under a Diagnosis-related Groups system (e.g., UK, France, and Nordic countries).

Differences in patients' access to health care (e.g., free of charge with universal coverage, existence of co-payments, and private sector-dominated) and to innovative treatments (related to national price-setting and reimbursement mechanisms) across Europe might also further explain the observed differences in costs and survival. Hence, a better understanding of the reasons behind the variation in resource use, costs, and patient outcomes is needed. The variation in care delivered for malignant blood disorders suggests that more harmonisation of cancer care guided by best practice guidance across Europe is needed. This approach would aid setting cancer health-care benchmarks in Europe and guide the provision of efficient and effective cancer services and national cancer-control plans to improve patient outcomes and experiences. Ideally, this would be done within a cost-effectiveness framework similar to that used by the UK's National Institute for Health and Care Excellence, where decisions about the implementation of interventions and reimbursement of cancer drugs explicitly consider their value for money.

Malignant blood disorders contributed to 8% of the total cancer costs (€143 billion) in the 28 EU countries alone in 2012.⁸ In terms of relative total costs, this placed malignant blood disorders behind lung (15%), breast (12%), and colorectal (10%) cancers, and ahead of prostate (8%) and bladder (3%) cancers.³ However, the ranking changed when we considered health-care expenditure,

with breast cancer accounting for 13% of all sites, followed by malignant blood disorders with 12% and colorectal and prostate cancers with 11% each.

In the USA, lymphoma and leukaemia had the highest cancer care costs of all sites (14%), followed by breast (13%) and colorectal (11%) cancers.²⁰ As with costs per prevalence case and per capita, we found considerable variation in the ranking of cancer sites by country in terms of both total costs and health-care costs that warrants further investigation. For example, after adjusting for price differentials, Germany accounted for the highest health-care expenditure per capita for breast cancer, but was ranked 11th for malignant blood disorders.³ Other countries such as Luxembourg were ranked in the top five highest spenders across the seven sites of cancer.

This analysis is not without limitations. There is a need for standardised disease and resource use cancer data across European countries²³ because with the exception of inpatient days, national data were largely absent for primary care, outpatient care, emergency visits, and pharmaceutical expenditure due to malignant blood disorders. In the absence of such data, we had to make assumptions and extrapolations to input the missing data and, as a result, we provide a grading system for each resource use and unit cost per country to highlight such gaps and guide future research (appendix pp 2, 5).

Furthermore, because of data unavailability, the costs by type of malignant blood disorder (e.g., Hodgkin's and non-Hodgkin lymphoma, and leukaemia) could not be broken down in a consistent and robust manner across all countries. This also meant that drug costs due to malignant blood disorders were ascertained with estimates from two countries (Germany and the Netherlands), which were then applied to the remaining countries. Sensitivity analysis showed alternative assumptions to result in changes of 9% on total cancer costs. Additionally, cancer drug costs included only antineoplastic drugs and endocrine treatment (Anatomical Therapeutic Chemical codes L1 and L2). Other drug costs used by patients with cancer (e.g., antiemetic's, immunosuppressant's, opioids, and blood products), were not included because of insufficient data about the proportion of these

drugs prescribed to patients with cancer. Furthermore, owing to data unavailability, the costs by time from diagnosis or by stage of cancer could not be estimated. Nonetheless, our aim was to measure the annual cost of individuals with malignant blood disorders and compare it with other types of cancers and across countries. Hence, we used a prevalence-based approach to estimate the costs of malignant blood disorders where the costs were measured within a year in each country regardless of when the disease was diagnosed. This method differs from estimating the costs of incident malignant blood disorders, which would require following a cohort of patients, from diagnosis, for the duration of cancer to estimate the lifetime costs of the disease. The two approaches are likely to produce different costs which combined would provide useful insights about the variation in costs, survival, and treatment pathways across the countries. More cancer intelligence is needed in the form of detailed cohort studies of patients with cancer and analysis of administrative-linked datasets to estimate the use of health-care resources and respective costs by type of cancer and disease stage.

Finally, our absolute costs are likely to be an underestimate. Because of data unavailability, we assumed the average time it takes to replace an absent worker (friction period) is 90 days across all European countries. This might result in under estimation of productivity costs because the friction period is likely to vary as a function of employment levels and flexibility of the labour market. Hence, we also report the productivity costs without the friction period approach. Some categories of health-care costs, public health activities, long-term morbidities resulting from cancer treatments among survivors, and care provided outside the health-care system (e.g., hospices based outside hospitals) is not recorded for all countries under study. However, the relative comparisons between malignant blood disorders and other cancers, in terms of proportion of total cancer costs, are less likely to be affected because these categories of health-care costs were also missing across all cancers.

Our study is the first to quantify the economic burden of malignant blood disorders in the 28 EU member countries, Iceland, Norway, and Switzerland. We believe that our study will be relevant to European policy-makers implementing affordable cancer care for their citizens.

Contributors

RL-F and JL designed the study. RB, RL-F, and JL contributed to the literature search, data collection, data analysis, data interpretation, and wrote the manuscript. RS contributed to data interpretation and wrote the manuscript. All authors approved the final version of the manuscript.

Declaration of interests

We declare no competing interests.

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Table 1. Costs of malignant blood disorders (€ thousands) in 31 European countries, by country, 2012

Country	Healthcare costs						% of total health expenditure	Productivity losses		Informal care costs	Total costs	
	Primary care	Outpatient care	A&E	Inpatient care	Medications	Total health care		Mortality	Morbidity		Total	% of GDP
Austria	5,769	9,674	357	93,487	53,052	162,339	0.5%	96,674	29,388	30,215	318,616	0.10%
Belgium	3,635	7,230	964	68,344	53,516	133,690	0.3%	92,070	69,929	49,012	344,701	0.09%
Bulgaria	1,602	1,900	233	8,732	6,731	19,198	0.6%	9,108	4,347	2,098	34,751	0.08%
Croatia	7,429	4,150	14,395	9,635	7,740	43,348	1.4%	19,136	23,749	5,972	92,206	0.21%
Cyprus	387	1,028	280	1,373	3,345	6,413	0.5%	5,311	1,299	2,456	15,478	0.08%
Czech Rep.	2,613	6,396	1,235	24,091	31,442	65,777	0.6%	12,185	14,444	5,580	97,986	0.06%
Denmark	853	28,600	1,502	50,782	31,703	113,438	0.4%	34,662	52,202	18,356	218,659	0.09%
Estonia	986	1,443	789	4,720	1,607	9,545	0.9%	2,248	3,963	647	16,404	0.09%
Finland	765	19,747	2,832	80,152	24,208	127,704	0.7%	30,353	16,439	14,058	188,554	0.09%
France	8,225	13,040	1,584	549,482	467,476	1,039,806	0.4%	184,169	179,355	115,530	1,518,860	0.07%
Germany	92,386	76,027	2,097	874,876	241,887	1,287,273	0.4%	358,325	681,223	181,476	2,508,296	0.09%
Greece	18,441	41,216	8,155	156,280	69,965	294,058	1.7%	11,705	8,524	4,789	319,076	0.16%
Hungary	6,055	9,382	1,563	23,321	31,938	72,259	0.9%	9,719	5,180	3,933	91,090	0.09%
Iceland	1,703	1,292	360	4,465	1,803	9,623	1.0%	4,788	887	1,418	16,716	0.15%
Ireland	10,669	11,140	5,886	66,242	19,587	113,524	0.7%	23,330	8,078	7,449	152,380	0.09%
Italy	61,462	68,749	45,916	499,886	257,121	933,134	0.6%	222,393	20,635	203,876	1,380,038	0.09%
Latvia	1,015	2,348	206	4,093	1,495	9,157	0.7%	3,058	2,197	866	15,279	0.07%
Lithuania	1,078	1,056	310	4,200	857	7,501	0.4%	2,821	3,183	906	14,410	0.04%
Luxembourg	674	1,219	84	8,164	3,975	14,115	0.5%	2,029	4,012	1,059	21,216	0.05%
Malta	50	83	30	1,216	1,527	2,906	0.4%	699	227	422	4,253	0.06%
Netherlands	12,513	19,175	1,668	199,774	55,438	288,569	0.4%	87,023	56,448	36,834	468,873	0.07%
Norway	2,390	15,913	3,437	106,319	23,107	151,166	0.4%	29,963	24,170	16,909	222,208	0.06%
Poland	20,194	62,568	2,310	48,533	40,751	174,357	0.7%	47,286	34,108	13,507	269,257	0.07%
Portugal	3,867	5,073	743	16,301	38,120	64,104	0.4%	36,787	10,703	14,040	125,633	0.07%
Romania	3,772	12,522	623	21,433	29,962	68,311	0.9%	21,846	12,435	3,664	106,257	0.08%
Slovakia	3,393	8,248	415	9,873	17,239	39,169	0.7%	7,496	6,628	1,898	55,191	0.08%
Slovenia	526	1,033	667	26,538	7,231	35,994	1.2%	3,330	26,075	2,093	67,493	0.19%
Spain	115,004	67,108	38,660	232,083	234,142	686,998	0.7%	121,252	62,635	85,504	956,388	0.09%
Switzerland	7,540	24,743	5,848	95,924	42,578	176,633	0.5%	36,619	79,660	19,399	312,310	0.07%
Sweden	8,696	6,443	1,239	90,902	61,497	168,778	0.3%	58,053	70,655	19,472	316,958	0.06%
UK	12,936	229,402	12,309	555,383	180,500	990,531	0.5%	307,977	184,867	115,919	1,599,294	0.08%
EU-28	403,839	734,301	151,663	3,734,916	1,955,132	6,979,851	0.5%	1,789,608	1,601,931	941,558	11,312,948	0.08%
Europe 31	416,628	757,949	156,699	3,936,602	2,041,539	7,309,417	0.5%	1,882,413	1,697,643	979,357	11,868,830	0.08%

Data are in thousands of euros (€). No adjustment for price differentials Data are in thousands of euros (€). No adjustment for price differentials

Table 2. Malignant blood disorders as a proportion of total cancer costs in the EU-28

	Malignant blood disorders (€ million)	Overall cancer* (€ million)	Proportion of costs due to malignant blood disorders
Healthcare costs	6,980	57,4587	12%
Mortality costs	1,790	50,224	4%
Morbidity costs	1,698	11,756	14%
Informal care costs	942	23,912	4%
Total costs	11,313	143,349	8%

*Overall cancer estimates obtained from Leal et al. (2016)⁸

Table 3. Proportion of total cancer costs due to different cancer types

	Healthcare costs	Mortality costs	Morbidity costs	Informal care costs	Total costs
Bladder*	5%	2%	3%	4%	3%
Malignant blood disorders	12%	4%	14%	4%	8%
Breast†	13%	8%	19%	14%	12%
Colorectal†	11%	9%	10%	12%	10%
Lung†	8%	23%	9%	16%	15%
Prostate†	11%	2%	4%	8%	7%

Estimates only apply to countries in the European Union

*Information obtained from Leal et al. (2016)⁸

†Information obtained from Luengo-Fernandez et al. (2013)

Figure 1. Health-care costs of malignant blood disorders per 10 citizens in 31 European countries in 2012, by health-care service category.

a) Cost data not adjusted for price differentials, b) Cost data adjusted for price differentials

b) Cost data adjusted for price differentials

Figure 2. Health-care costs of malignant blood disorders per prevalent case in 31 European countries in 2012, by health-care service category.

a) Cost data not adjusted for price differentials,

b) Cost data adjusted for price differentials

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Online Appendix

In this online appendix, we provide detailed methodology and data sources used for the estimation of the costs of malignant blood disorders in 31 European countries. We also provide additional results of the costs of malignant blood disorders in the EU-28, Iceland, Norway and Switzerland.

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Methods and data sources

Healthcare expenditure

Five categories of healthcare service associated with care for malignant blood disorders were included: primary care, accident and emergency (A&E) care, hospital inpatient care, outpatient care, and drugs.

The methods used and respective data sources are reported in **Table 1** and are discussed in greater detail in the following sections.

Table 1. Sources used to obtain healthcare resource use, by category and country.

Country	Primary care	Outpatient care	A&E	Inpatient care
Austria	B ^{1,2}	B ^{1,2}	C ^{1,2}	A ^{*3}
Belgium	C ⁴	C ⁵	C ⁶	A ^{*7}
Bulgaria	C ⁸	C ⁸	C ⁹	A ^{*10,11}
Croatia	C ¹²	C ¹³	D	A ^{*10,11}
Cyprus	A ^{14,15}	A ^{14,15}	C ^{14,15}	A ^{*10,11}
Czech Rep.	C ¹⁶	C ¹⁶	D	A ^{*7}
Denmark	A ^{*17,18}	A ^{*17,18}	A ^{*17,19}	A ^{*19}
Estonia	C ²⁰	C ²⁰	C ²⁰	D
Finland	B ^{21,22}	B ^{23,24}	C ^{23,24}	A ^{*10,11}
France	B ^{25,26}	B ^{26,27}	C ^{26,28}	A ^{*29}
Germany	A ^{*30,31}	A ^{*30,31}	A ³²	A ^{*33}
Greece	C ³⁴	C ³⁴	D	A ³⁵
Hungary	C ³⁶	C ³⁷	C ³⁸	A ^{*10,11}
Iceland	C ³⁹	C ³⁹	D	A ^{*7}
Ireland	C ⁴⁰	C ⁴¹	C ⁴¹	A ^{*42}
Italy	C ³⁰	C ³⁰	C ⁴³	A ^{10,11}
Latvia	C ⁴⁴	C ⁴⁴	C ⁴⁴	A ^{*7}
Lithuania	C ⁴⁵	C ⁴⁵	D	A ^{*7}
Luxembourg	C ⁴⁶	C ⁴⁶	D	A ^{*10,11}
Malta	C ⁴⁷	C ⁴⁷	C ⁴⁷	A ^{*10,11}
Netherlands	A ^{*48,49}	A ^{*48,49}	C ^{49,50}	A ^{10,11}
Norway	C ⁵¹	A ^{*52}	C ⁵¹	A ^{*52}
Poland	C ⁵³	C ⁵⁴	C ⁵⁵	A ^{*56}
Portugal	C ⁵⁷	C ⁵⁷	C ⁵⁸	A ^{10,11}
Romania	C ⁵⁹	C ⁵⁹	C ⁶⁰	A ^{*10,11}
Slovakia	C ⁶¹	C ⁶¹	C ⁶²	A ^{*63}
Slovenia	A ^{64,65}	A ^{64,65}	D	A ^{*10,11}
Spain	C ^{66,67}	B ^{67,68}	B ^{67,68}	A ^{*69}
Sweden	B ^{70,71}	B ⁷⁰	D	A ^{*72}
Switzerland	C ⁷³	C ⁷³	C ⁷⁴	A ^{*7}
UK	A ^{*75-77}	B ⁷⁸⁻⁸²	B ^{79,80,82-84}	A [*]

Dependent on the availability of data, the methods used to estimate disease-related healthcare resource use fell in one of the following categories, in order of priority:

A*. National malignant blood disorders data: Malignant blood disorders-specific healthcare data were available for the whole population;

A. National cancer-specific data: Cancer-specific healthcare data were available for the whole population;

B. Survey/sample cancer-specific data: Cancer-specific healthcare data were available for a representative sample of the population either as the proportion of overall healthcare utilisation that was due to cancer or as healthcare utilisation rates per patient with the condition, e.g. annual outpatient visits per patient;

C. National data but not cancer-specific: All-cause healthcare resource use data were available but not due to cancer. For non-inpatient categories, we estimated cancer-specific resource use by multiplying all-cause national data by the proportion of ambulatory visits due to cancer out of all ambulatory visits, if available. If disease-

related ambulatory information was not available, we used the proportion of hospital discharges due to cancer out of all discharges to allocate national healthcare utilisation;

D. No national data: we derived national utilisation data for all diseases from similar countries and allocated it into cancer using the approach defined in (C).

Primary care

Primary care activities consisted of visits to or from general practitioners (GPs). Country-specific overall visits to primary care due to all conditions were obtained for all countries.^{1,4,8,12,14,16,17,20,21,25,30,34,36,39,40,44-48,51,53,57,59,61,64,66,70,73,75,77} To the total number of primary care visits we applied the proportion of primary care that was attributable to cancer using the following:

In Finland,²² data were available for a published study evaluating the reasons for primary care attendance in a cohort of Finnish citizens;

In Austria,² Cyprus,¹⁵ Denmark,¹⁸ Slovenia,⁶⁵ Sweden,⁷¹ and the UK⁷⁶ published data were available on the proportion of primary consultations due to cancer;

In France,²⁶ Germany,³¹ and the Netherlands,⁴⁹ data on ambulatory healthcare expenditure was available by disease group and healthcare usage attributable to cancers was derived by dividing disease expenditure by the respective unit costs.

In Spain,⁶⁷ the proportion of cancer-related outpatient visits out of all outpatient visits was available and was applied to the total number of primary care visits.

In the remaining 20 countries, the proportion of hospital discharges (including day cases) due to cancers out of all discharges was applied to the total number of primary care visits.

The proportion of primary care cancer visits due to malignant blood disorders was available for Denmark,¹⁸ Germany,³¹ the Netherlands,⁴⁹ Spain,⁶⁷ and the UK.⁷⁶ For all other countries, we evaluated the proportion of total cancer visits due to malignant blood disorders from the proportion of cancer-related hospital discharges due malignant blood disorders, applying these to the total number of cancer-related primary care visits.

Outpatient care

Outpatient care comprised specialist consultations and treatments taking place in outpatient wards, clinics, or patients' homes. Country-specific overall visits to outpatient care due to all conditions were obtained for all countries.^{1,5,8,13,14,16,17,20,23,27,30,34,37,39,41,44-48,52,54,57,59,61,64,68,70,73,78-81} To the total number of outpatient care visits we applied the proportion of care that was attributable to cancer using the following:

1. In Austria,² Cyprus,¹⁵ Denmark,¹⁸ Finland,²⁴ Norway,⁵² Slovenia,⁶⁵ Spain,⁶⁷ and Sweden²⁴ published data were available on the proportion of outpatient care consultations due to cancer.

In France,²⁶ Germany,³¹ and the Netherlands,⁴⁹ data on ambulatory care expenditure by disease group were used to derive the number of visits due to cancer by applying the respective proportion of expenditure, out of all ambulatory expenditure, to the total number of outpatient care visits.

In the UK, we obtained data from a study that used expert opinion to identify the proportion of total outpatient visits that could be attributable to cancer for each specialty.⁸²

In the remaining 20 countries, the proportion of overall hospital discharges due to non-malignant blood disorders was applied to the total number of outpatient visits.

The proportion of outpatient care cancer visits due to malignant blood disorders was available for Denmark,¹⁸ Germany,³¹ the Netherlands,⁴⁹ Norway,⁵² and Spain.⁶⁷ For all other countries, we evaluated the proportion of total cancer visits due to malignant blood disorders from the proportion of cancer-related hospital discharges due malignant blood disorders, applying these to the total number of cancer-related outpatient care visits.

Accident & Emergency care

A&E care consisted of all cancer-related hospital emergency visits. Country-specific overall visits to A&E due to all conditions were obtained for 24 countries.^{1,6,9,14,17,20,23,28,32,38,41,43,44,47,50,51,55,58,60,62,68,74,79,80,83,84}

All-cause attendance figures were not available in 7 countries (Croatia, Czech Republic, Greece, Lithuania, Luxembourg, Slovenia, and Sweden) and A&E rates had to be derived from similar countries and applied to them. Therefore, for: 1) Czech Republic we used estimates from Slovakia;⁶² 2) Lithuania we used estimates from Estonia;²⁰ 3) Luxembourg we used estimates from Belgium;⁶ 4) Sweden we used estimates from Denmark;¹⁷ and 5) Croatia, Greece and Slovenia we used estimates from a previous multicountry regression.⁸⁵

To the total number of emergency care visits we applied the proportion of care that was attributable to cancer using the following:

- 1) In Denmark¹⁹ and Germany³² published data were available on the proportion of A&E consultations due to cancer.
- 2) In Austria,² Cyprus,¹⁵ Finland,²⁴ Norway,⁵² Slovenia,⁶⁵ Spain,⁶⁷ and Sweden,²⁴ data on the proportion of all outpatient care visits due to cancer were applied to the total number of A&E visits.
- 3) In France,²⁶ and the Netherlands,⁴⁹ data on outpatient expenditure by disease group were used to derive the number of A&E visits due to cancer, by applying the respective proportions of expenditure to the overall number of A&E visits.
- 4) In the UK, we obtained data from a study that used expert opinion to identify the proportion of total emergency care visits that could be attributable to cancer for each specialty.⁸²
- 5) For the remaining 21 countries, all-cause A&E visits were obtained and allocated into cancer using the proportion of overall hospital discharges due to cancer.

The proportion of emergency care cancer due to malignant blood disorders was available for Denmark,¹⁹ the Netherlands,⁴⁹ Norway,⁵² and Spain.⁶⁷ For all other countries, we evaluated the proportion of total cancer A&E visits due to malignant blood disorders from the proportion of cancer-related hospital discharges due to each cancer out of all cancer hospital discharges and applied these to the total number of cancer-related emergency care visits.

Hospital inpatient care

Except for Estonia, national data were available on cancer-related days in hospital and day-cases. For all countries this information was obtained from EUROSTAT,^{10,11} bar for Greece, where the information was obtained from the OECD.³⁵

Hospital bed-days and day cases due to malignant blood disorders were obtained directly for 26 countries. For:

1. Austria,³ Denmark,¹⁹ France,²⁹ Germany,³³ Ireland,⁴² Norway,⁵² Poland,⁵⁶ Slovakia,⁶³ Spain,⁶⁹ and Sweden,⁷² this information was obtained from national sources such as ministries of health or national statistical institutes;
Belgium, the Czech Republic, Iceland, Latvia, Lithuania, Switzerland and the UK this information was obtained from the WHO European Hospital Morbidity Database;⁷ and
Bulgaria, Croatia, Cyprus, Finland, Hungary, Luxembourg, Malta, Romania and Slovenia this information was obtained from data supplied to us by EUROSTAT.^{10,11}

For Estonia, age- and gender-standardised rates of hospital bed-days and day cases due to malignant blood disorders in Latvia were applied to Estonian population estimates. For Greece, Italy, the Netherlands and Portugal, Eurostat (or OECD in the case of Greece) provided detailed data on resource usage for a number of individual cancers, but not malignant blood disorders. As a result, we obtained the number of hospital bed days and day cases due to all other cancers, and then applied the proportion of all these cancers that were due to

malignant blood disorders using information from Belgium for the Netherlands, Cyprus for Greece, and Spain for Italy and Portugal.

Healthcare unit costs

For all countries, health care resource use was valued using country-specific unit costs (**Table 2.**).

Table 2. Sources used to obtain healthcare unit costs, by category and country.

Country	Primary care	Outpatient care	A&E	Inpatient care
Austria	A ⁸⁶	A ⁸⁶	A ⁸⁷	B ⁸⁸
Belgium	A ⁸⁹	A ⁸⁹	A ⁸⁹	A ⁹⁰
Bulgaria	B ⁸⁸	B ⁸⁸	D ⁸⁵	B ⁸⁸
Croatia	A ⁹¹	A ⁹¹	A ⁹¹	A ⁹¹
Cyprus	A ⁹²	A ⁹³	D ⁸⁵	A ⁹³
Czech Rep.	B ⁹⁴	B ⁹⁴	D ⁸⁵	B ⁹⁴
Denmark	A ¹⁷	A ¹⁸	A ⁹⁵	A ⁹⁶
Estonia	B ²⁰	A ²⁰	B ²⁰	A ²⁰
Finland	A ⁹⁷	A ²⁴	A ⁹⁵	A ²⁴
France	B ⁹⁸	B ⁹⁹	A ¹⁰⁰	B ⁸⁸
Germany	A ¹⁰¹	A ¹⁰¹	A ¹⁰¹	B ³¹
Greece	A ¹⁰²	A ¹⁰²	A ¹⁰²	A ¹⁰²
Hungary	B ³⁸	B ³⁸	A ³⁸	A ³⁸
Iceland	A ¹⁰³	A ¹⁰³	B ¹⁰⁴	B ¹⁰⁴
Ireland	A ¹⁰⁵	A ¹⁰⁵	A ¹⁰⁵	A ¹⁰⁶
Italy	A ¹⁰¹	A ¹⁰⁷	A ¹⁰¹	A ¹⁰⁸
Latvia	B ¹⁰⁹	B ¹⁰⁹	D ⁸⁵	A ¹¹⁰
Lithuania	B ⁴⁵	B ⁴⁵	A ¹⁰¹	B ⁴⁵
Luxembourg	A ¹¹¹	A ¹¹¹	A ¹¹¹	B ⁸⁸
Malta	B ⁴⁷	C ¹¹²	A ¹¹³	A ¹¹³
Netherlands	B ⁴⁸	A ¹¹⁴	A ¹¹⁴	B ⁴⁹
Norway	A ¹¹⁵	A ¹¹⁵	C ¹¹²	A ¹¹⁵
Poland	A ¹¹⁶	A ¹¹⁷	D ⁸⁵	A ¹¹⁶
Portugal	A ¹¹⁸	A ¹¹⁹	A ¹¹⁹	A ¹¹⁹
Romania	C ¹¹²	C ¹¹²	D ⁸⁵	B ⁸⁸
Slovakia	C ¹¹²	C ¹¹²	D ⁸⁵	B ⁸⁸
Slovenia	C ¹¹²	C ¹¹²	A ¹¹³	B ⁸⁸
Spain	A ¹²⁰	A ¹²⁰	A ¹²⁰	A ¹²⁰
Sweden	A ¹²¹	A ¹²¹	A ¹²²	A ¹²³
Switzerland	A ¹²⁴	A ¹²⁵	A ¹²⁶	A ¹²⁴
UK	A ¹²⁷	A ¹²⁸	A ¹²⁸	A ¹²⁸

Dependant on the availability of data, sources were qualified in order of priority:

- A. Directly obtained from sources such as national fee schedules, published studies, national reports, etc.;
- B. Derived from national expenditure figures (e.g. primary care, outpatient care, inpatient care) using the respective total activity levels. For example, cost per inpatient day was estimated by dividing the total inpatient expenditure by the total number of inpatient days;
- C. Estimates derived costs and prices used in the WHO-CHOICE analysis;¹¹²
- D. Derived from the predictions of linear regression analyses of the unit costs of countries with available data.⁸⁵

Drug expenditure

Drug expenditure consisted of the sum of retail and hospital sales of antineoplastic agents and endocrine therapy (ATC codes L1 and L2). For all the countries in the EU-28 this information was obtained from a previous publication for the year 2009,⁸⁵ and updated to 2012 expenditure estimates using European expenditure growth estimates on cancer drugs.¹²⁹ For Iceland, expenditure on ATC L drugs was obtained¹³⁰ and the proportion of ATC L due to L1 and L2 drugs in Sweden was applied. For Norway, expenditure on ATC L1 and L2 drugs was

obtained.¹³¹ For Switzerland, overall expenditure on drugs was obtained,¹³² and the proportion of that expenditure that was for ATC L1 and L2 drugs was obtained from Germany.³¹

As only Germany and the Netherlands provided information on the proportion of cancer-related medicine expenditure on the different types of cancer,^{31,49} the proportion of pharmaceutical expenditure on malignant blood disorders was averaged across the two countries and applied to total L1 and L2 sales in the remaining countries.

Non-health care utilisation

Informal care

We conservatively assumed that only patients severely limited in daily activities or who were terminally ill would receive informal care. We used country-specific data from IARC¹³³ to estimate the number of people with cancer and malignant blood disorders and then used data from the Survey of Health, Ageing and Retirement in Europe (SHARE)¹³⁴ to assess the informal care needs of cancer and malignant blood disorder patients. Hence, we estimated the hours of informal care provided due to cancer using Wave 2 and Wave 4 of the SHARE survey which collected data on more than 30,000 individuals resident in 17 EU countries in 2006 and 2010 (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Slovenia, Spain and Sweden). Residents from Ireland and Greece were not included in WAVE 4 and the data collected in WAVE 2 in these countries were combined with WAVE 4 data on the remaining 15 EU countries. For countries not in SHARE, we combined data from similar countries that were in SHARE to obtain estimates for the 14 remaining countries. Therefore, for: 1) Bulgaria, Croatia, Latvia, Lithuania, Romania, and Slovakia, we pooled data from the Czech Republic, Estonia, Hungary, Slovenia and Poland; 2) For Finland, Iceland and Norway, we pooled data from Denmark and Sweden; 3) for Cyprus and Malta, we pooled data from Greece, Italy, Portugal and Spain; and 4) for Luxembourg, Switzerland and the UK, we pooled data from Austria, Belgium, France, Germany, Ireland, and the Netherlands.

Informal care to patients severely limited in daily activities due to malignant blood disorders

Hours of informal care for severely limited cancer patients were estimated by adding the age and sex-specific products of:

1) Prevalence of cancer in the population.

We obtained country-specific data on prevalence of cancer and malignant blood disorders from IARC.¹³³ These prevalence figures were then allocated to different age-groups using estimates from SHARE, whereby using logistic regression analysis we estimated probability of having cancer conditional on age, gender, and country of residence.

2) Probability of being severely limited in daily activities due to cancer.

Using data from SHARE, we undertook logistic regressions adjusting for age, gender, presence of cancer, presence of other health conditions, and country of residence, in order to obtain country-specific estimates of the probability of being severely limited in daily activities due to cancer.

3) Probability of receiving informal care due to cancer.

Using data from SHARE, we performed two logistic regressions (one for care from inside household and another for care outside the household) to evaluate the probability that cancer patients received informal care after adjusting for age, gender, presence of cancer, presence of other health conditions, and country of residence.

4) Hours of informal care received due to cancer.

Using data from SHARE we performed an ordered logistic regression to assess the amount of informal care time (almost daily, almost weekly, almost every month or less often) that patients with cancer received after adjusting for age, gender, presence of cancer, limitations in daily living, presence of other health conditions, and country of residence. These were converted into hours using the information from SHARE on the number of unpaid care hours (either daily, weekly, monthly or annually) patients with cancer received.

We then obtained country-specific prevalence estimates of the number of patients with cancer and malignant blood disorders from IARC.¹³³ To apportion the total hours of informal care received by cancer patients to malignant blood disorders, for each country, multiplied the hours of informal care received due to cancer by the proportion of malignant blood disorders out of all cancers.

Informal care to terminally ill patients with malignant blood disorders

Hours of informal care for terminally ill cancer patients were estimated by adding the age and sex-specific products of:

- 1) Number of cancer deaths.

Age- and gender-stratified cancer deaths were derived from EUROSTAT.¹³⁵

- 2) Probability of receiving informal care in the year before dying from cancer.

Using the end-of-life questionnaire, participants in SHARE were asked to report whether they had provided unpaid care for anyone who had died in the last year, including the age of the person to whom care was provided and the health conditions from which that person was suffering. The probability of providing informal care for a cancer patient was estimated using a logistic regression analysis and adjusting for age, gender and country.

- 3) Hours of informal care received due to cancer.

Using data from end-of-life questionnaire in SHARE, we performed an ordered logistic regression to assess the amount of informal care time (almost daily, almost weekly, almost every month or less often) that caregivers provided to a terminally-ill cancer patient after adjusting for age, gender, presence of cancer, and country of residence. These were converted into hours using the information from SHARE on the number of unpaid care hours (either daily, weekly, monthly or annually) that caregivers provided to cancer patients.

We then obtained country-specific number of deaths due to cancer and malignant blood disorders from EUROSTAT.¹³⁵ To apportion the total hours of informal care provided to terminally ill patients due to malignant blood disorders, for each country, we multiplied the hours of informal care provided due to cancer by the proportion of malignant blood disorder deaths out of all cancer deaths.

Valuing informal care hours

Participants in SHARE were asked about the relationship between carer and person being cared (e.g. spouse, sibling, offspring, parent friend etc...). We assumed that spouses, siblings and friends providing the care would be of similar age to the patient, therefore carers of patients aged 65 years or more were assumed to be retired, and those carers of patients aged less than 65 years were assumed to be of working-age. If care was being provided by either the patients' children or their children's spouses, then it was assumed that these informal carers would be under 65 years of age. Using gender-specific economic activity and unemployment rates for each country, we then determined the proportion of these carers who were employed or unemployed/economically inactive.

The mean net hourly wage rate was applied to informal care provided by those carers in working age and who were economically active and in employment. Annual earnings were adjusted to hourly wage rates, assuming there were 230 working days each year, and each day consisted of 8 hours of work. For those carers in retirement, unemployed, or economically inactive, the national hourly minimum wage was applied.¹³⁶ For those countries with no official minimum wage rate (Cyprus, Denmark, Finland, Germany, Italy and Sweden), the worst paid sector in the economy was proxied as a minimum wage.

Mortality losses

For all countries we assumed an initial working age of 15. Age and gender specific deaths due to malignant blood disorders, were obtained for all countries from EUROSTAT.¹³⁵ The number of potential working years lost was then estimated as the difference between the age at death and maximum age of retirement (which we set at 79 years of age). However, this estimate would overestimate the total working years lost as not everyone will be economically active (i.e. either working or actively searching for work) or employed. Therefore, age- and gender-specific unemployment and activity rates, obtained from EUROSTAT,¹³⁷ for each of the 31 countries were applied to the potential foregone earnings due to premature mortality. The total number of working years lost was then multiplied by gender-specific average annual earnings.¹³⁸

Morbidity losses

The costs associated with lost productivity due to morbidity were the costs associated with absence of work due to malignant blood disorders. Morbidity losses could occur due to: individuals taking absence from leave for a defined period of time; or due to individuals being declared incapacitated or disabled due to their condition, and therefore leaving the labour market. **Table 3** details all the sources used to obtain temporary and permanent absence from work due to malignant blood disorders.

Table 3. Sources used to obtain morbidity losses, by country

Country	Temporary absence from work	Permanent absence from work
Austria	139	139
Belgium	140	140
Bulgaria	141	142
Croatia	12	12
Cyprus	143	143
Czech Rep.	144	16,144
Denmark	145,146	146,147
Estonia	20	148
Finland	149,150	150
France	151,152	153
Germany	154,155	156
Greece	143	143
Hungary	157	157
Iceland	158,159	158,159
Ireland	160	161
Italy	162,163	164,165
Latvia	166	167
Lithuania	168	169
Luxembourg	170	46,170
Malta	171	47
Netherlands	172,173	173,174
Norway	175,176	176,177
Poland	178	178,179
Portugal	180	181
Romania	182	142
Slovakia	183	183
Slovenia	65	64,184
Spain	151,185	185,186
Sweden	70,146	70,146
Switzerland	187	188
UK	189,190	191

Temporary absence from work due to sickness

Country-specific overall annual days of sickness leave due to all conditions was obtained for all countries.^{12,20,65,70,139-141,143-146,149,151,154,157,158,160,162,166,168,170-172,175,178,180,182,183,187,189} To this we applied the proportion of sickness leave that was attributable to cancers, which was available in Austria,¹³⁹ the Czech Republic,¹⁴⁴ Denmark,¹⁴⁶ France,¹⁵² Germany,¹⁵⁵ Italy,¹⁶³ Luxembourg,¹⁷⁰ the Netherlands,¹⁷³ Norway,¹⁷⁶ Poland,¹⁷⁸ Slovenia,⁶⁵ Spain,¹⁸⁵ Sweden,¹⁴⁶ and the UK.¹⁹⁰ For Belgium,¹⁴⁰ Finland,¹⁵⁰ and Iceland¹⁵⁹ we used the proportion of overall permanent absence from work due to cancers.

For countries where we could not establish the proportion of sickness leave attributable to cancer, we used proportions from other countries. Therefore, for:

- 1) Bulgaria, Estonia, Hungary, Latvia, Lithuania and Romania we used estimates from Poland;¹⁷⁸
- 2) Croatia we used estimates from Slovenia;⁶⁵
- 3) Cyprus, Greece and Portugal we used estimates from Spain;¹⁸⁵
- 4) Ireland we used estimates from the UK;¹⁹⁰
- 5) Malta we used estimates from Italy;¹⁶³
- 6) Slovakia we used estimates from the Czech Republic;¹⁴⁴ and
- 7) Switzerland we used estimates from Germany.¹⁵⁵

Except for France, Germany, and the UK where the proportion of sickness leave/incapacity attributable to malignant blood disorders was available, for all other countries the proportion of cancer-specific absent days from work due to malignant blood disorders was obtained by assuming that this would be the same as the proportion of overall days in hospital due to the condition in the working age population. We hypothesised that the higher the number of days spent in hospital, the higher the number of working days lost due to illness.

Permanent absence from work due to incapacity or disability

Country-specific information on the numbers of working-age individuals receiving incapacity or disability benefits and not being able to work due to all conditions was obtained for all countries.^{12,16,46,47,64,139,140,142,143,147,148,150,153,156-158,161,165,167,169,174,177,179,181,183,186,188,191} To this we applied the proportion that was attributable to cancer, which was available in Austria,¹³⁹ Belgium,¹⁴⁰ Finland,¹⁵⁰ France,¹⁵³ Germany,¹⁵⁶ Iceland,¹⁵⁹ Italy,¹⁶⁴ Slovenia,¹⁸⁴ and the UK.¹⁹¹ For the Czech Republic,¹⁴⁴ Denmark,¹⁴⁶ Luxembourg,¹⁷⁰ the Netherlands,¹⁷³ Norway,¹⁷⁶ Poland,¹⁷⁸ Spain,¹⁸⁵ and Sweden,¹⁴⁶ we used the proportion of overall temporary absence from work due to cancer.

For countries where we could not establish the proportion of permanent absence from work due to incapacity or disability attributable to cancer, we used proportions from other countries using the methodology to estimate temporary absence from work due to sickness. As with temporary absence from work, excepting France, Germany, and the UK where the proportion of sickness leave/incapacity attributable to malignant blood disorders was available, for all other countries the proportion of cancer-specific permanent absence from work due to malignant blood disorders was obtained by assuming that this would be the same as the proportion of overall days in hospital due to the condition in the working age population. We hypothesised that the higher the number of days spent in hospital, the higher the permanent absence from work due to illness.

Valuing absence from work

The mean annual earnings identified when estimating informal care and mortality costs were converted to mean daily earnings.¹³⁸ The product of working days lost and mean daily earnings provided the productivity losses associated with non-malignant blood disorders, after adjusting for the 'friction period'

Table 4. Average unit costs (€), by country, 2012, and across all countries (unweighted average)

Country	Mortality losses		Morbidity losses	Informal care		Health care unit costs			
	Yearly earnings			Daily earnings	Hourly earnings		GP visit	Outpatient visit	A&E visit
	Males	Females	Carers in employment		Carers not in employment				
Austria	€47,247	€34,448	€180	€22	€10	€48	€62	€133	€495
Belgium	€48,926	€41,935	€199	€25	€8	€27	€55	€73	€697
Bulgaria	€6,006	€5,197	€24	€3	€1	€8	€23	€32	€111
Croatia	€13,748	€13,073	€58	€7	€2	€17	€14	€230	€97
Cyprus	€30,331	€24,059	€119	€15	€6	€15	€40	€46	€135
Czech Rep.	€14,715	€11,302	€58	€7	€2	€11	€15	€78	€227
Denmark	€64,616	€50,814	€252	€32	€12	€25	€83	€134	€691
Estonia	€12,559	€9,018	€47	€6	€2	€16	€52	€105	€187
Finland	€48,662	€38,001	€189	€24	€12	€100	€286	€311	€782
France	€38,281	€31,079	€152	€19	€9	€34	€131	€91	€949
Germany	€45,940	€35,594	€179	€22	€7	€50	€63	€82	€573
Greece	€25,252	€20,488	€101	€13	€4	€23	€54	€58	€383
Hungary	€12,109	€10,152	€49	€6	€2	€6	€11	€123	€173
Iceland	€35,239	€27,564	€137	€17	€6	€66	€110	€264	€996
Ireland	€48,333	€38,794	€191	€24	€10	€52	€167	€286	€862
Italy	€35,466	€29,911	€144	€18	€9	€22	€83	€227	€707
Latvia	€10,396	€8,394	€41	€5	€2	€9	€41	€37	€101
Lithuania	€8,620	€7,182	€34	€4	€2	€10	€22	€24	€79
Luxembourg	€56,892	€50,716	€236	€29	€12	€38	€61	€75	€1,038
Malta	€20,985	€18,015	€87	€11	€4	€28	€53	€103	€389
Netherlands	€47,270	€37,814	€186	€23	€9	€42	€126	€176	€1,426
Norway	€61,376	€51,978	€248	€31	€25	€124	€270	€308	€1,487
Poland	€12,091	€10,282	€49	€6	€2	€16	€61	€34	€206
Portugal	€20,097	€16,538	€80	€10	€4	€31	€94	€89	€200
Romania	€7,230	€6,655	€30	€4	€1	€8	€12	€67	€67
Slovakia	€12,351	€9,470	€48	€6	€2	€20	€29	€38	€171
Slovenia	€22,839	€21,481	€97	€12	€5	€25	€37	€98	€344
Spain	€31,074	€25,170	€123	€15	€5	€38	€93	€185	€630
Sweden	€41,766	€35,259	€168	€21	€15	€166	€357	€336	€904
Switzerland	€67,546	€52,566	€264	€33	€12	€70	€318	€142	€1,012
UK	€42,440	€29,348	€158	€20	€8	€53	€156	€135	€614
Mean (unadjusted)	€31,948	€25,881	€127	€16	€7	€39	€96	€133	€540
Mean (PPP-adjusted)	€31,064	€25,275	€123	€15	€6	€36	€89	€137	€510

Table 5. Malignant blood disorders-related resource units per 1,000 population, by country 2012

Country	Mortality losses				Morbidity losses Working days lost	Informal care				Healthcare contacts			
	Deaths		Working years lost			Care hours				GP visits	Outpatient visits	A&E visits	Inpatient days
	M	F	M	F		Carers in employment	Carers not in employment	in					
Austria	0.11	0.11	0.26	0.15	19	103		134	14	19	0	22	
Belgium	0.11	0.10	0.17	0.10	32	93		252	12	12	1	9	
Bulgaria	0.06	0.05	0.22	0.13	24	63		192	27	11	1	11	
Croatia	0.11	0.10	0.37	0.14	95	111		239	105	69	15	23	
Cyprus	0.07	0.07	0.18	0.15	13	120		177	31	30	7	12	
Czech Rep.	0.03	0.03	0.08	0.04	24	52		73	23	40	1	10	
Denmark	0.04	0.03	0.11	0.05	37	78		71	6	62	2	13	
Estonia	0.03	0.03	0.14	0.08	64	58		77	48	21	6	19	
Finland	0.05	0.04	0.12	0.06	16	64		93	1	13	2	19	
France	0.04	0.03	0.08	0.04	18	45		99	4	2	0	9	
Germany	0.04	0.04	0.10	0.05	46	63		125	23	15	0	19	
Greece	0.01	0.01	0.05	0.02	8	18		44	72	68	13	37	
Hungary	0.03	0.03	0.09	0.04	11	39		74	108	85	1	14	
Iceland	0.13	0.09	0.56	0.12	20	192		178	80	37	4	14	
Ireland	0.04	0.03	0.99	0.07	9	41		67	44	15	4	17	
Italy	0.05	0.05	0.12	0.05	2	97		192	48	14	3	12	
Latvia	0.04	0.03	0.17	0.05	26	53		82	56	28	3	20	
Lithuania	0.03	0.03	0.13	0.04	31	43		78	37	16	4	18	
Luxembourg	0.04	0.02	0.09	0.00	32	41		69	34	38	2	15	
Malta	0.03	0.04	0.07	0.05	6	53		98	4	4	1	7	
Netherlands	0.04	0.03	0.13	0.05	18	51		106	18	9	1	8	
Norway	0.04	0.03	0.11	0.04	20	57		65	4	12	2	14	
Poland	0.02	0.02	0.11	0.05	18	34		62	33	27	2	6	
Portugal	0.04	0.04	0.20	0.08	13	87		124	12	5	1	8	
Romania	0.02	0.02	0.15	0.09	20	35		48	23	51	0	16	
Slovakia	0.02	0.03	0.11	0.08	25	37		61	31	52	2	11	
Slovenia	0.03	0.03	0.07	0.03	131	51		82	10	14	3	37	
Spain	0.04	0.03	0.10	0.04	11	77		131	65	15	4	8	
Sweden	0.04	0.03	0.10	0.04	50	48		70	5	7	2	11	
Switzerland	0.04	0.03	0.12	0.06	34	46		76	16	3	1	11	
UK	0.04	0.04	0.13	0.06	18	58		83	4	23	1	14	
EU-28	0.04	0.04	0.12	0.05	22	61		112	28	20	2	13	
Europe 31	0.04	0.04	0.12	0.05	23	61		111	28	20	2	13	

Table 6. Total healthcare costs and total costs of malignant blood disorders (€) per prevalent case (5-year) and per 10 citizens, in 31 European countries, by country, 2012

Country	Healthcare costs per 10 citizens		Total costs per 10 citizens		Healthcare costs per prevalent case		Total costs per prevalent case	
	Unadjusted	PPP-adjusted	Unadjusted	PPP-adjusted	Unadjusted	PPP-adjusted	Unadjusted	PPP-adjusted
Austria	193	175	379	344	25,453	23,094	49,955	45,325
Belgium	120	109	311	280	10,631	9,596	27,412	24,743
Bulgaria	26	56	47	101	5,346	11,377	9,677	20,594
Croatia	101	159	216	338	11,847	18,563	25,200	39,485
Cyprus	74	82	180	198	7,371	8,120	17,791	19,598
Czech Rep.	63	89	93	133	8,873	12,605	13,218	18,778
Denmark	203	151	392	290	22,199	16,442	42,790	31,692
Estonia	72	102	124	175	10,570	14,905	18,166	25,616
Finland	236	196	349	289	21,741	18,014	32,100	26,598
France	159	142	233	207	13,578	12,098	19,834	17,672
Germany	157	152	306	297	15,505	15,006	30,213	29,239
Greece	264	296	287	321	34,514	38,594	37,450	41,877
Hungary	73	126	92	159	13,024	22,534	16,419	28,406
Iceland	301	279	523	484	32,077	29,702	55,720	51,595
Ireland	248	226	333	303	27,494	25,075	36,905	33,658
Italy	157	156	232	231	12,912	12,857	19,097	19,015
Latvia	45	66	75	110	7,349	10,834	12,262	18,077
Lithuania	25	41	48	79	3,307	5,431	6,354	10,434
Luxembourg	269	228	404	342	24,895	21,078	37,417	31,681
Malta	70	91	102	133	9,225	12,033	13,502	17,612
Netherlands	172	158	280	257	16,931	15,513	27,510	25,206
Norway	303	193	446	283	28,025	17,820	41,195	26,194
Poland	45	77	70	118	9,801	16,578	15,135	25,601
Portugal	61	76	119	150	6,768	8,493	13,264	16,645
Romania	34	71	53	111	7,243	15,156	11,266	23,574
Slovakia	72	106	102	150	10,832	15,863	15,263	22,351
Slovenia	175	216	328	406	20,120	24,864	37,726	46,622
Spain	147	162	204	226	18,691	20,650	26,020	28,747
Switzerland	186	138	329	244	18,755	13,878	33,161	24,539
Sweden	212	139	398	261	18,617	12,208	34,961	22,927
UK	156	138	252	223	15,889	14,092	25,654	22,752
Europe 31	141	141	229	229	15,126	15,126	24,560	24,560

Table 7. Costs of malignant blood disorders, excluding ICD-10 D47, (€ thousands) in 31 European countries, by country, 2012

Country	Healthcare costs						Productivity losses		Informal care costs	Total
	Primary care	Outpatient care	A&E	Inpatient care	Drugs	Total health care	Mortality	Morbidity		
Austria	5,508	9,237	178	91,085	53,052	159,060	95,311	28,682	30,215	313,268
Belgium	3,443	6,847	913	65,386	53,516	130,105	91,754	66,218	49,012	337,089
Bulgaria	1,463	1,736	213	8,203	6,731	18,347	9,105	4,076	2,098	33,626
Croatia	7,050	3,938	13,661	9,181	7,740	41,570	18,746	23,141	5,972	89,429
Cyprus	371	988	269	1,359	3,345	6,332	5,164	1,297	2,456	15,249
Czech Rep.	2,510	6,144	1,186	23,246	31,442	64,528	11,867	13,879	5,580	95,854
Denmark	793	28,550	1,489	49,833	31,703	112,368	33,447	51,266	18,356	215,437
Estonia	921	1,348	737	4,475	1,607	9,087	2,246	3,855	647	15,836
Finland	747	19,226	2,757	78,416	24,208	125,354	28,682	16,333	14,058	184,427
France	8,031	12,732	1,547	517,373	467,476	1,007,158	179,227	179,355	115,530	1,481,270
Germany	80,639	66,361	1,948	851,119	241,887	1,241,954	348,099	672,704	181,476	2,444,232
Greece	17,890	39,984	7,911	155,547	69,965	291,297	11,705	8,213	4,789	316,004
Hungary	5,901	9,144	1,524	22,706	31,938	71,214	9,159	5,075	3,933	89,380
Iceland	1,665	1,263	352	4,403	1,803	9,486	4,767	875	1,418	16,546
Ireland	9,805	10,238	5,410	63,689	19,587	108,729	21,689	8,005	7,449	145,871
Italy	54,093	60,507	40,412	463,981	257,121	876,114	210,141	19,641	203,876	1,309,772
Latvia	948	2,192	192	3,883	1,495	8,710	3,015	2,137	866	14,729
Lithuania	1,025	1,004	295	4,076	857	7,256	2,720	3,119	906	14,001
Luxembourg	655	1,186	82	8,108	3,975	14,005	1,925	3,991	1,059	20,980
Malta	48	79	29	1,211	1,527	2,895	699	225	422	4,241
Netherlands	11,416	17,494	1,522	190,340	55,438	276,210	85,517	52,783	36,834	451,344
Norway	2,325	15,745	3,328	105,144	23,107	149,648	28,843	23,736	16,909	219,136
Poland	18,606	57,648	2,129	44,724	40,751	163,858	45,786	31,924	13,507	255,076
Portugal	2,942	3,860	371	15,345	38,120	60,639	34,240	10,312	14,040	119,230
Romania	3,349	11,118	553	19,805	29,962	64,787	21,359	11,658	3,664	101,469
Slovakia	3,296	8,011	403	9,649	17,239	38,599	7,493	6,487	1,898	54,477
Slovenia	464	981	634	25,225	7,231	34,535	3,278	25,426	2,093	65,333
Spain	111,135	64,850	37,359	219,343	234,142	666,829	116,520	60,350	85,504	929,203
Switzerland	7,356	24,140	5,705	94,598	42,578	174,378	34,566	78,504	19,399	306,847
Sweden	8,515	6,309	1,214	89,355	61,497	166,890	56,585	69,788	19,472	312,735
UK	11,627	221,263	11,952	542,844	180,500	968,186	298,295	181,977	115,919	1,564,376
EU-28	372,035	690,806	141,381	358,4749	1,955,132	6,744,102	1,731,755	1,570,636	941,558	10,998,052
Europe 31	384,540	714,123	146,274	3,783,651	2,041,539	7,070,127	1,821,949	1,665,036	979,357	11,536,469

Table 8. Proportion of all cancer expenditure that was due to malignant blood disorders, in the EU-28, by cost category and by country, 2012. Expenditure in all cancers obtained from Leal et al. 2016.

Country	Healthcare costs			Productivity losses		Informal care costs	Total costs
	Inpatient care	Drugs	Total healthcare	Mortality	Morbidity		
Austria	11%	14%	12%	9%	8%	9%	10%
Belgium	13%	14%	13%	7%	9%	8%	9%
Bulgaria	16%	13%	15%	6%	10%	5%	9%
Croatia	15%	9%	18%	7%	10%	7%	11%
Cyprus	34%	14%	20%	9%	20%	10%	13%
Czech Rep.	9%	14%	10%	2%	6%	3%	6%
Denmark	18%	14%	19%	3%	13%	2%	8%
Estonia	15%	14%	13%	3%	10%	3%	8%
Finland	16%	14%	14%	5%	15%	4%	10%
France	12%	14%	12%	3%	6%	4%	7%
Germany	9%	9%	9%	3%	30%	4%	7%
Greece	29%	21%	27%	2%	12%	2%	15%
Hungary	9%	13%	12%	2%	7%	2%	7%
Ireland	17%	14%	19%	4%	8%	4%	10%
Italy	13%	14%	13%	4%	12%	4%	8%
Latvia	15%	12%	15%	3%	10%	3%	7%
Lithuania	13%	9%	12%	2%	8%	3%	6%
Luxembourg	14%	14%	14%	3%	10%	4%	9%
Malta	16%	15%	14%	5%	19%	4%	9%
Netherlands	9%	19%	10%	3%	10%	4%	7%
Poland	9%	14%	14%	3%	6%	2%	7%
Portugal	11%	14%	11%	3%	12%	4%	6%
Romania	14%	13%	14%	3%	10%	2%	7%
Slovakia	10%	14%	11%	4%	6%	3%	8%
Slovenia	29%	14%	22%	2%	21%	3%	13%
Spain	11%	14%	12%	4%	12%	4%	8%
Sweden	14%	14%	13%	3%	15%	4%	9%
UK	17%	14%	16%	4%	13%	4%	8%
EU-28	12%	13%	12%	4%	14%	4%	8%

Table 9. Mean number of inpatient care days per prevalent cancer in the EU-28 due to malignant blood disorders and all cancers, by country, 2012. Inpatient care days for all cancers and prevalence obtained from Leal et al. 2016.

Country	Malignant blood disorders		All cancers	
	Inpatient care days per prevalent case	Prevalent cases	Inpatient care days per prevalent case	Prevalent cases
Austria	30	6,378	15	114,793
Belgium	8	12,575	5	192,018
Bulgaria	22	3,591	8	75,554
Croatia	27	3,659	11	61,969
Cyprus	12	870	3	10,420
Czech Rep.	14	7,413	8	145,631
Denmark	14	5,110	5	92,520
Estonia	28	903	11	14,791
Finland	17	5,874	8	83,641
France	8	76,580	4	1,121,491
Germany	18	83,021	12	1,396,766
Greece	48	8,520	14	101,880
Hungary	24	5,548	13	113,182
Ireland	19	4,129	8	54,920
Italy	10	72,266	5	1,012,541
Latvia	32	1,246	11	24,462
Lithuania	23	2,268	11	34,785
Luxembourg	14	567	7	8,264
Malta	10	315	4	5,207
Netherlands	8	17,044	5	267,924
Poland	13	17,790	7	350,227
Portugal	9	9,472	5	134,272
Romania	34	9,432	13	178,416
Slovakia	16	3,616	10	56,296
Slovenia	43	1,789	9	28,909
Spain	10	36,756	6	581,688
Sweden	11	9,418	5	156,481
UK	15	62,340	7	827,126
EU-28	14	468,490	8	7,246,174

Table 10. Countries ranked in terms of healthcare expenditure per 10 citizens and per type of cancer, adjusted for price differentials (PPP)

Highest expenditure	All cancers		Blood cancers		Bladder cancer		Colorectal cancer		Lung cancer		Breast cancer		Prostate cancer		Rank
	Country	€	Country	€	Country	€	Country	€	Country	€	Country	€	Country	€	
From lowest to highest healthcare cost	Germany	1771	Greece	296	Italy	90	Germany	198	Luxembourg	174	Germany	268	Germany	Germany	1
	Luxembourg	1657	Luxembourg	228	Luxembourg	79	Luxembourg	183	Germany	153	Luxembourg	212	Luxembourg	Luxembourg	2
	Netherlands	1533	Ireland	226	Netherlands	73	Netherlands	150	Netherlands	115	Greece	183	Greece	Netherlands	3
	Finland	1490	Slovenia	216	Germany	72	Austria	140	Austria	114	Austria	169	Finland	Finland	4
	Austria	1463	Finland	196	Spain	67	Ireland	129	Ireland	107	Netherlands	168	France	Austria	5
	Spain	1306	Austria	175	Greece	64	Finland	126	Greece	106	Finland	163	Austria	Spain	6
	Ireland	1252	Spain	162	France	62	Italy	125	Finland	96	France	130	Sweden	Ireland	7
	Italy	1226	Croatia	159	Austria	60	Belgium	105	Italy	89	Ireland	124	Spain	Italy	8
	France	1156	Netherlands	158	Finland	56	Czech Rep	104	Poland	84	Spain	120	Ireland	France	9
	Sweden	1088	Italy	156	Sweden	52	UK	100	UK	78	Slovakia	109	Italy	Sweden	10
	Greece	1083	Germany	152	Czech Republic	47	Spain	96	Slovakia	74	Belgium	108	Slovenia	Greece	11
	Hungary	1068	Denmark	151	Belgium	47	Slovakia	92	Belgium	72	Estonia	103	Belgium	Hungary	12
	Belgium	988	France	142	Slovenia	44	Estonia	90	Sweden	71	Italy	102	Czech Rep	Belgium	13
	Slovenia	981	United Kingdom	138	Slovakia	44	France	89	Czech Rep	71	Czech Rep	101	Hungary	Slovenia	14
	Slovakia	941	Sweden	138	United Kingdom	40	Greece	88	Slovenia	69	UK	98	Slovakia	Slovakia	15
	United Kingdom	877	Hungary	126	Ireland	39	Slovenia	88	Denmark	68	Sweden	97	Denmark	United Kingdom	16
	Croatia	867	Belgium	109	Portugal	39	Denmark	82	France	63	Hungary	94	Netherlands	Croatia	17
	Czech Republic	856	Slovakia	106	Hungary	37	Poland	74	Hungary	59	Denmark	91	Portugal	Czech Republic	18
	Denmark	803	Estonia	102	Poland	35	Portugal	64	Estonia	56	Slovenia	91	UK	Denmark	19
	Estonia	777	Malta	91	Croatia	34	Hungary	62	Spain	52	Portugal	83	Estonia	Estonia	20
	Portugal	765	Czech Republic	89	Malta	33	Sweden	59	Portugal	37	Malta	81	Malta	Portugal	21
	Malta	633	Cyprus	82	Estonia	32	Malta	59	Latvia	31	Cyprus	78	Romania	Malta	22
	Poland	544	Poland	77	Denmark	30	Cyprus	42	Romania	29	Poland	70	Poland	Poland	23
	Romania	492	Portugal	76	Cyprus	25	Latvia	41	Malta	27	Latvia	59	Cyprus	Romania	24
	Latvia	453	Romania	71	Romania	20	Romania	35	Cyprus	27	Romania	57	Latvia	Latvia	25
	Cyprus	434	Latvia	66	Latvia	19	Lithuania	35	Lithuania	22	Bulgaria	53	Bulgaria	Cyprus	26
	Bulgaria	371	Bulgaria	56	Bulgaria	16	Bulgaria	34	Bulgaria	17	Lithuania	32	Lithuania	Bulgaria	27
	Lithuania	337	Lithuania	41	Lithuania	15							Lithuania	Lithuania	28

Table 11. Countries ranked in terms of total expenditure per 10 citizens and per type of cancer, adjusted for price differentials (PPP)

Highest expenditure	All cancers		Blood cancers		Bladder cancer		Colorectal cancer		Lung cancer		Breast cancer		Prostate cancer	
	Country	€	Country	€	Country	€	Country	€	Country	€	Country	€	Country	€ Rank
From lowest to highest healthcare cost	Germany	4111	Greece	296	Luxembourg	142	Germany	430	Netherlands	596	Germany	565	Germany	307 1
	Netherlands	3862	Luxembourg	228	Italy	137	Netherlands	391	Germany	581	Netherlands	383	Sweden	222 2
	Denmark	3857	Ireland	226	Netherlands	126	Sweden	385	Luxembourg	558	Luxembourg	376	Luxembourg	211 3
	Luxembourg	3789	Slovenia	216	Germany	120	Luxembourg	353	Denmark	504	France	337	Austria	191 4
	Austria	3394	Finland	196	Lithuania	119	Denmark	343	Greece	459	Austria	301	Greece	189 5
	Belgium	3164	Austria	175	Spain	118	Ireland	295	Belgium	453	Belgium	298	Finland	178 6
	Finland	3119	Denmark	164	Denmark	113	Austria	286	Austria	412	Finland	294	France	171 7
	Slovenia	3116	Spain	162	Belgium	98	Italy	286	Ireland	391	Denmark	270	Denmark	170 8
	Croatia	3042	Croatia	159	Austria	98	Portugal	264	Italy	385	Greece	263	Belgium	163 9
	Ireland	2942	Netherlands	158	Sweden	97	Belgium	257	UK	367	Sweden	262	Netherlands	159 10
	Italy	2915	Italy	156	Slovenia	96	UK	251	Portugal	350	Ireland	257	Italy	158 11
	France	2802	Germany	152	France	96	Slovenia	248	Slovenia	340	Italy	248	Ireland	153 12
	Spain	2749	France	142	Greece	93	Finland	221	Hungary	320	Estonia	243	Slovenia	152 13
	Sweden	2735	Lithuania	142	Portugal	84	Spain	220	Poland	314	UK	242	Spain	145 14
	United Kingdom	2639	United Kingdom	138	Croatia	81	Estonia	206	France	313	Spain	224	Portugal	135 15
	Portugal	2551	Sweden	138	Finland	80	France	197	Sweden	296	Portugal	208	UK	132 16
	Hungary	2291	Hungary	126	Czech Republic	77	Czech Rep	192	Spain	292	Slovenia	207	Czech Rep	124 17
	Czech Republic	2129	Belgium	109	Poland	69	Greece	174	Finland	266	Slovakia	187	Slovakia	111 18
	Estonia	2106	Slovakia	106	Ireland	65	Poland	164	Cyprus	256	Czech Rep	187	Hungary	105 19
	Greece	2103	Estonia	102	Malta	63	Hungary	162	Estonia	238	Cyprus	186	Estonia	98 20
	Slovakia	1978	Cyprus	94	Slovakia	61	Slovakia	161	Czech Rep	233	Hungary	166	Cyprus	83 21
	Poland	1726	Malta	91	Hungary	61	Malta	149	Romania	207	Malta	159	Malta	72 22
	Romania	1612	Czech Republic	89	Cyprus	59	Cyprus	119	Slovakia	191	Latvia	156	Poland	71 23
	Latvia	1549	Poland	77	Estonia	57	Latvia	107	Latvia	169	Poland	146	Lithuania	69 24
	Cyprus	1547	Portugal	76	United Kingdom	56	Romania	103	Malta	153	Lithuania	122	Romania	64 25
	Malta	1457	Romania	71	Romania	43	Lithuania	101	Lithuania	140	Romania	117	Latvia	60 26
	Lithuania	1359	Bulgaria	56	Bulgaria	34	Bulgaria	87	Bulgaria	124	Bulgaria	98	Bulgaria	45 27
	Bulgaria	1082	Latvia	46	Latvia	29								28

Figure 1. Association between healthcare expenditure due to malignant blood disorders per prevalent case (€) and gross national product per capita (€)

The table below reports the output from the OLS regression:

Healthcare expenditure due to malignant blood disorders per prevalent case	Coefficient	95% CI	P-value
GDP per capita	0.248	(0.157 to 0.339)	<0.0001
Constant	8722.921	(4856.778 to 12589.06)	<0.0001
R-squared	0.36		
Prob > F	<0.0001		

Figure 2. Association between healthcare expenditure due to malignant blood disorders per prevalent case (€) and total healthcare expenditure per capita (€)

The table below reports the output from the OLS regression:

Healthcare expenditure due to malignant blood disorders per prevalent case	Coefficient	95% CI	P-value
Total healthcare expenditure per capita	2.460	(1.355 to 3.566)	<0.0001
Constant	9373.028	(5515.499 to 13230.56)	<0.0001
R-squared	0.34		
Prob > F	0.0001		

Table 12. Association between healthcare expenditure due to malignant blood disorders per prevalent case (€) and mortality-to-incidence ratio, adjusted for price differentials (PPP)

Healthcare expenditure due to malignant blood disorders per prevalent case	Coefficient*	95% CI	P-value
Mortality to incidence ratio	0.019	(-0.189 to 0.227)	0.852
Constant	16357.87	(10084.81 to 22630.93)	<0.0001
R-squared	0.002		
Prob > F	0.85		

* Output from OLS regression

Table 13. Association between healthcare expenditure due to malignant blood disorders per prevalent case (€) and cancer mortality (per 100,000), adjusted for price differentials (PPP)

Healthcare expenditure due to malignant blood disorders per prevalent case	Coefficient*	95% CI	P-value
Cancer mortality	2.603	(-658.656 to 663.863)	0.994
Constant	16852.47	(10433.83 to 23271.11)	<0.0001
R-squared	<0.0001		
Prob > F	0.99		

* Output from OLS regression

Table 14. Association between healthcare expenditure due to malignant blood disorders per prevalent case (€) and cancer incidence (per 100,000), adjusted for price differentials (PPP)

Healthcare expenditure due to malignant blood disorders per prevalent case	Coefficient*	95% CI	P-value
Cancer incidence	-118.526	(-376.273 to 139.221)	0.355
Constant	20833.72	(11162.24 to 30505.21)	0.0001
R-squared	0.015		
Prob > F	0.36		

* Output from OLS regression

Figure 3. Tornado plot of the results of the sensitivity analysis on the total costs of malignant blood disorders in 31 European countries, € billions, 2012

The horizontal axis represent the total costs of malignant blood disorders in 31 European countries. The categories/parameters being changed are displayed along the vertical axis. The horizontal bars represent the range in total costs associated with the specified change for each category/parameter, e.g. $\pm 20\%$ change in earnings across all countries. Blue bars represent reductions and red bars represent increases in total costs of malignant blood disorders associated with the value of the category being changed. The labels represent the upper and lower bounds of total costs of malignant blood disorders for a given category parameter. The base-case total costs of malignant blood disorders (€12 billion) are indicated by a vertical line cutting through the horizontal bars.

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