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Platinum Priority – Bladder Cancer

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Economic Burden of Bladder Cancer Across the European Union

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Abstract

Background: More than 120 000 people are diagnosed annually with bladder cancer in the 28 countries of the European Union (EU). With >40 000 people dying of it each year, it is the sixth leading cause of cancer. However, to date, no systematic cost-of-illness study has assessed the economic impact of bladder cancer in the EU.
Objective: To estimate the annual economic costs of bladder cancer in the EU for 2012.
Design, setting, and participants: Country-specific cancer cost data were estimated using aggregate data on morbidity, mortality, and health care resource use, obtained from numerous international and national sources.
Outcome measurements and statistical analysis: Health care costs were estimated from expenditures on primary, outpatient, emergency, and inpatient care, as well as medications. Costs of unpaid care and lost earnings due to morbidity and early death were estimated.
Results and limitations: Bladder cancer cost the EU €4.9 billion in 2012, with health care accounting for €2.9 billion (59%) and representing 5% of total health care cancer costs. Bladder cancer accounted for 3% of all cancer costs in the EU (€143 billion) in 2012 and represented an annual health care cost of €57 per 10 EU citizens, with costs varying >10 times between the country with the lowest cost, Bulgaria (€8 for every 10 citizens), and highest cost, Luxembourg (€93). Productivity losses and informal care represented 23% and 18% of bladder cancer costs, respectively. The quality and availability of comparable cancer-related data across the EU need further improvement.
Conclusions: Our results add to essential public health and policy intelligence for delivering affordable bladder cancer care systems and prioritising the allocation of public research funds.
Patient summary: We looked at the economic costs of bladder cancer across the European Union (EU). We found bladder cancer to cost €4.9 billion in 2012, with health care accounting for €2.9 billion. Our study provides data that can be used to inform affordable cancer care in the EU.

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1. Introduction

Cancer is a major health problem in the European Union (EU). In 2009 it cost the health care systems of the 27 countries in the EU €51 billion, representing 4% of total health care expenditures [1]. Including the burden associated with lost earnings, both from early mortality and absence from work, and the costs of informal care, whereby relatives and/or friends provided unpaid care for people with cancer, the costs increased to €126 billion.

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Although the study by Luengo-Fernandez et al (2013) [1] quantified the costs for breast, colorectal, lung, and prostate cancer, it did not evaluate how much of total cancer costs could be attributed to bladder cancer. Bladder cancer is the sixth leading cause of cancer in the EU [2], with 124 000 people diagnosed and >40 000 people dying from the disease each year. By 2030 the annual incidence is projected to increase to 219 000, two-fifths of this due to the ageing of the European population [2]. Planning urologic care systems across Europe requires not only good epidemiology but also investment and cost-effective treatments and pathways. Critical to these calculations is the macroeconomic impact of bladder cancer.

The aim of this study is to evaluate the economic burden of bladder cancer across the 28 countries that made up the EU in 2012. We included health care and non–health care costs and also updated the economic burden of all cancers for 2012.

2. Methods

Cancer was defined by the World Health Organisation International Classification of Diseases, 10th revision, as codes C00–C97, and bladder cancer was defined as C67. For all countries we used the same methodological framework to obtain data and value cancer-related resource use [1,3,4]. An annual time frame was adopted, whereby resource use attributable to cancer and bladder cancer within the most recent year for which data were available were measured, regardless of disease onset. Resource use was valued by applying country-specific unit costs. Costs were converted to 2012 prices [5], and national currencies were converted to euros (€) using 2012 exchange rates. To allow comparisons between countries, we also adjusted for cost of living using the purchasing power parity (PPP) method [6]. This method measures the price of the same bundle of goods in different countries and allows comparisons of costs adjusted for differences in the cost of living between countries.

International and national sources were consulted for country-specific aggregate data (see Supplement 1 for more detail). We also consulted peer-reviewed published studies or national reports from governmental or professional bodies. If no data were found, extrapolations were performed from similar countries (eg, similar health care expenditure per person, life expectancy, and geographic location).

2.1. Health care expenditure

Cancer health care service included primary care, accident and emergency (A&E) care, hospital inpatient care, outpatient care, and medications (see Supplement 1 for methodology, data sources, and the quality of each data estimate). Other types of activities relating to the prevention of cancer such as health education in community-based settings were not included because of the difficulties in identifying activity levels.

Country-specific pharmaceutical expenditures on cancer for 2009 were obtained. This consisted of sales of antineoplastic agents and endocrine treatment (Anatomical Therapeutic Chemical codes L1 and L2) [1]. Expenditures for 2009 were updated to 2012 by assuming a 4.6% annual growth in cancer-related pharmaceutical expenditures [7]. Due to the absence of EU-level data on cancer-related pharmaceutical expenditures due to bladder cancer, this proportion (4%) was obtained from reports from Germany (2%) and the Netherlands (6%) and applied to the remaining countries [8,9].

2.2. Informal care costs

Informal care costs were equivalent to the opportunity cost of unpaid care, that is, the time (work and/or leisure) that caregivers forgo, valued in monetary terms, to provide unpaid care for relatives with cancer. We used country-specific data from the International Agency for Research on Cancer (IARC) [2] to estimate the number of people with cancer and bladder cancer and data from the Survey of Health, Ageing and Retirement in Europe [10] to assess the hours of informal care needed by cancer and bladder cancer patients (see Supplement 1).

2.3. Productivity losses

Productivity costs included the foregone earnings related to cancer-attributable mortality and morbidity. For all countries we assumed an initial working age of 15 yr. Age- and gender-specific deaths due to cancer and bladder cancer were obtained for all countries from Eurostat [11]. The potential working-years lost was estimated as the difference between the age at death and maximum age of retirement (which we set at 79 yr). However, this would overestimate the total working-years lost because not everyone will be economically active (ie, either working or actively searching for work) or employed. Therefore, age- and gender-specific unemployment and activity rates for each of the 28 countries were applied to the potential foregone earnings due to premature mortality [12]. The total number of working-years lost was then multiplied by gender-specific average annual earnings [13]. Future earnings lost due to mortality were discounted to present values using a 3.5% annual rate (ie, the value society attaches to present as opposed to future costs).

Costs due to cancer-related morbidity comprised both the costs associated with individuals declared incapacitated or disabled because of cancer (permanent absence) and the costs due to individuals taking sickness leave for a defined time period (temporary absence) (see Supplement 1). Costs were estimated by multiplying the total working time lost due to cancer by mean earnings [12]. We used the friction period approach because absent workers are likely to be replaced, whereby costs for temporary and permanent absences were counted only during the time taken to replace a worker (first 90 d of work absence).

2.4. Noneconomic burden

We obtained noneconomic measures of burden of cancer and bladder cancer including number of deaths [11], incident disease cases [2], prevalent disease cases (5 yr) [2], and disability-adjusted life years (DALYs) lost. The rate, per 100 000 in the population, of DALYs lost for cancer and bladder cancer was obtained for 2010 [14] and applied to 2012 population estimates [15].

2.5. Statistical analysis

We explored variations between countries in cancer-related health care costs per capita using ordinary least squares (OLS) univariate regression analyses conditional on national income (per capita), health care expenditure (per capita), cancer incidence (crude rate), cancer mortality (crude rate), mortality-to-incidence ratio (MIR), proportion of the population who smoke, and cancer-specific DALYs (rate per 100 000). An explanatory variable was significant if its p value was <0.05. All regression analyses were performed using Stata software v.12.1 (StataCorp, College Station, TX, USA).

2.6. Sensitivity analysis

We estimated the effects on the total costs of bladder cancer of changes in (1) health care resource use (all categories) and earnings (male and female) across all countries, (2) proportion of cancer-related pharmaceutical expenditure due to bladder cancer (2% and 6%), (3) discounting rate for productivity losses due to early mortality, and (4) no friction period for costs due to cancer-related morbidity.

Table 1 – Noneconomic burden of cancers and bladder cancer

Country	Deaths		Incidence		Prevalence, 5-yr data		DALYs	
	Cancer	Bladder cancer	Cancer	Bladder cancer	Cancer	Bladder cancer	Cancer	Bladder cancer
Austria	19 757	490	40 973	2159	114 793	7492	363 264	7811
Belgium	27 367	926	65 056	4348	192 018	14 220	554 321	12 670
Bulgaria	16 562	485	31 884	1662	75 554	4958	375 315	9496
Croatia	13 481	366	22 776	1053	61 969	3709	243 436	5362
Cyprus	1110	45	3417	227	10 420	803	27 652	734
Czech Republic	27 834	767	57 461	2462	145 631	8192	584 071	14 014
Denmark	14 886	492	35 984	1781	92 520	5607	300 846	9146
Estonia	3550	106	6095	209	14 791	607	59 171	1374
Finland	11 579	252	28 300	1093	83 641	3781	214 365	4040
France	155 331	5112	370 228	11 166	1 121 491	34 160	3 280 323	85 854
Germany	218 889	5516	491 825	28 403	1 396 766	100 676	4 237 296	105 824
Greece	27 159	1031	40 794	2777	101 880	9673	506 209	18 542
Hungary	32 460	904	50 286	2689	113 182	8057	656 401	14 103
Ireland	8094	188	20 655	666	54 920	2106	161 838	2979
Italy	167 251	5701	353 184	18 281	1 012 541	65 153	2 985 331	94 377
Latvia	6039	200	10 304	425	24 462	1233	101 110	2574
Lithuania	8110	248	14 462	569	34 785	1647	143 397	3163
Luxembourg	1018	42	2475	96	8264	540	22 329	469
Malta	840	33	1893	131	5207	492	16 748	463
Netherlands	42 359	1228	93 015	2999	267 924	10 296	835 530	21 415
Poland	92 610	3111	151 517	7960	350 227	23 566	1 969 546	55 534
Portugal	24 978	810	48 855	2874	134 272	8804	510 242	12 841
Romania	47 307	1391	78 316	3824	178 416	11 272	972 887	23 110
Slovakia	12 073	303	23 919	933	56 296	2666	269 049	4886
Slovenia	5834	184	11 407	463	28 909	1292	104 851	2460
Spain	103 307	4936	214 588	13 789	581 688	47 225	2 028 353	73 973
Sweden	21 646	684	50 262	2350	156 481	7885	387 014	9919
United Kingdom	157 581	4914	326 273	8776	827 126	27 410	2 913 926	69 591
TOTAL EU	1 269 012	40 465	2 646 204	124 165	7 246 174	413 522	24 824 821	666 726

DALY = disability-adjusted life year; EU = European Union.

3. Results

3.1. Noneconomic burden

In 2012 cancer was diagnosed in 2.6 million people; 124 000 of these were due to bladder cancer (5%; Table 1). More than 7 million people were estimated to be either living with or having survived cancer, with 410 000 (6%) due to bladder cancer. Approximately 1.3 million people died of cancer; 3% of these were due to bladder cancer (Table 1). Furthermore, 25 million DALYs were due to cancer, of which >660 000 were due to bladder cancer (3%).

3.2. Economic burden of bladder cancer

Bladder cancer cost the EU €4.9 billion in 2012 (Table 2 and Supplementary Table 5). The five most populous countries (ie, France, Germany, Italy, Spain, and the United Kingdom) accounted for €3.6 billion (73% of all costs).

Bladder cancer cost EU health care systems €2.9 billion in 2012 (Table 2), representing 59% of the total economic burden. Inpatient care was the major cost component, accounting for 58% (€1.7 billion) of health care costs, followed by expenditures on drugs at €568 million (20% of total health care costs). Annual health care costs of bladder cancer were equivalent to €57 per every 10 EU citizens (Fig. 1) but varied widely between countries, with a 12-time difference between the lowest (Bulgaria: €8 for every 10 citizens) and highest cost per capita (Luxembourg: €93 for every 10 citizens). Health care costs were €6942 per prevalent case, but these also varied considerably between countries, with a five-time difference between the lowest (Latvia: €2257) and highest spender (France: €11 937), after adjusting for price differentials (Supplementary Fig. 1).

The OLS regression showed a strong positive association between bladder cancer health care costs (per capita and per prevalent case) and national health care expenditures ($p < 0.01$) and national income ($p < 0.01$). No significant associations between bladder cancer health care costs (per capita and per prevalence case) and incidence, mortality, MIR, smoking rates, and DALYs were identified (Supplementary Figures 3–9).

Unpaid care accounted for >88 million hours with a cost of €900 million (18% of total costs; Table 2). Approximately 34 000 working-years were lost due to mortality, which were valued at €770 million (16% of total costs). We estimated that 3 million working-days were lost in 2012 due to cancer-related morbidity, which, when adjusted using the friction period, accounted for €330 million (7% of the total economic burden).

Sensitivity analysis showed that a 20% variation in health care resource use had the biggest impact on total bladder cancer costs (12% change), with the resulting total costs

Table 2 – Costs of bladder cancer (€ thousands) in the European Union, by country, 2012

Country	Health care costs							Productivity losses		Informal care costs	Total costs	
	Primary care	Outpatient care	A&E	Inpatient care	Medications	Total health care	Total cancer health expenditure, %	Mortality	Morbidity		Total	Total cancer cost, %
Austria	1617	2709	1105	34 680	15 784	55 895	4	13 126	9 976	12 153	91 151	3
Belgium	2453	4879	651	33 763	15 922	57 668	5	17 998	18 820	26 503	120 990	3
Bulgaria	416	493	70	2555	2003	5538	4	2776	1905	1567	11 785	3
Croatia	1053	588	2039	2110	3382	9172	4	4537	5382	2881	21 972	3
Cyprus	119	312	123	393	995	1941	6	1130	316	1196	4584	4
Czech Republic	2793	6836	1320	14 964	9213	35 126	6	7572	7503	6392	56 594	4
Denmark	301	898	264	11 789	9416	22 668	4	21 009	15 804	25 656	85 137	3
Estonia	272	496	237	1485	478	2967	4	1083	598	675	5323	3
Finland	1440	9020	1302	17 395	7202	36 360	4	6817	1 663	7557	52 397	3
France	10 062	15 951	1938	289 682	139 084	456 717	5	97 052	47 475	101 911	703 154	3
Germany	45 531	37 469	989	461 769	64 208	609 965	4	157 594	78 163	170 065	1 015 787	3
Greece	4317	9649	1909	34 199	13 250	63 323	6	10 594	4651	14 035	92 603	4
Hungary	1311	2031	338	7305	10 169	21 155	3	6561	1606	5671	34 994	3
Ireland	1350	1410	745	10 450	5828	19 782	3	6829	1474	4542	32 627	2
Italy	60 396	67 557	45 120	284 646	76 499	534 216	7	80 530	7671	192 078	814 495	5
Latvia	312	722	63	1029	511	2638	4	1382	494	1155	5669	3
Lithuania	480	470	138	1184	399	2671	4	1875	685	1065	6296	3
Luxembourg	285	516	39	2877	1183	4900	5	1612	884	1425	8821	4
Malta	27	44	16	411	555	1053	5	405	45	511	2012	4
Netherlands	9043	13 858	1206	93 303	16 422	133 832	5	50 550	16 564	28 717	229 663	3
Poland	9042	28 015	1034	30 337	11 977	80 405	6	33 293	20 825	22 216	156 740	4
Portugal	4567	7541	1877	7323	11 342	32 649	5	19 678	4738	13 915	70 980	3
Romania	854	2834	127	6188	8939	18 942	4	11 885	4849	5560	41 237	3
Slovakia	2005	4874	245	3805	5129	16 058	5	1909	2663	2050	22 680	3
Slovenia	217	459	297	4159	2151	7283	4	2709	3508	2514	16 014	3
Spain	43 539	25 406	14 636	131 669	69 662	284 912	5	65 856	19 621	128 151	498 540	4
Sweden	4665	15 309	3618	30 240	12 585	66 416	5	17 313	21 533	18 404	123 666	4
United Kingdom	3793	71 664	4192	153 029	53 702	286 380	5	126 204	29 754	101 291	543 630	3
TOTAL EU	212 258	332 009	85 637	1 672 739	567 991	2 870 634	5	769 879	329 170	899 857	4 869 542	3

A&E = accident and emergency; EU = European Union.

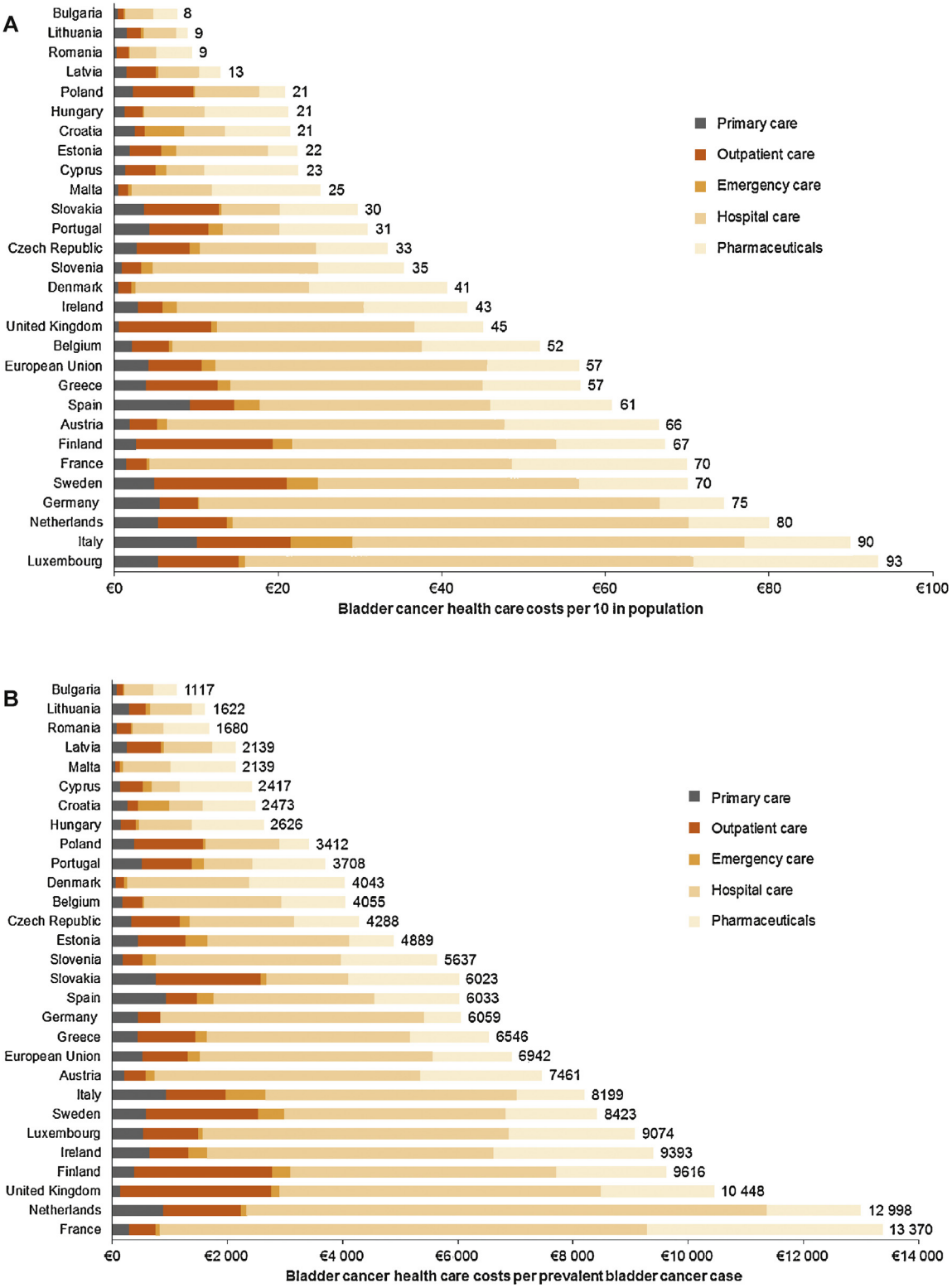

Fig. 1 – Total health care costs (€), not adjusted for price differentials, of bladder cancer by health care service category (A) per 10 in the population, 2012, and (B) per prevalent bladder cancer case.

varying between €4.3 and €5.4 billion (Supplementary Fig. 10). The 20% variation in earnings resulted in an 8% change on total bladder cancer costs, with these varying between €4.5 and €5.3 billion.

3.3. *Bladder cancer as a proportion of total cancer costs*

The total cancer costs in the EU were estimated at €143 billion in 2012 (Table 3 and Supplementary Table 8),

Table 3 – Costs of cancer (€ thousands) in the European Union, by country, 2012

Country	Health care costs							Productivity losses		Informal care costs	Total costs	
	Primary care	Outpatient care	A&E	Inpatient care	Medications	Total health care	Total health expenditure, %	Mortality	Morbidity		Total	GDP, %
Austria	35 888	60 134	24 517	842 330	392 932	1 355 801	4	1 062 446	369 546	357 421	3 145 215	1.02
Belgium	35 515	70 632	9418	702 639	396 369	1 214 574	3	1 263 559	783 295	627 126	3 888 554	1.03
Bulgaria	9240	10 964	1565	56 170	49 861	127 799	5	159 855	41 868	42 949	372 472	0.93
Croatia	24 875	13 896	48 201	65 496	84 196	236 665	8	273 979	231 915	87 481	830 040	1.91
Cyprus	1068	2808	765	4540	24 773	33 955	3	56 585	6601	23 941	121 082	0.68
Czech Republic	32 018	78 366	15 129	278 463	229 354	633 331	6	523 448	236 458	181 275	1 574 512	1.03
Denmark	6899	56 498	7855	299 211	234 398	604 861	2	1 167 468	396 098	737 586	2 906 014	1.18
Estonia	7988	14 579	6973	31 623	11 905	73 067	7	64 522	39 182	21 156	197 928	1.14
Finland	38 094	190 986	27 561	535 402	179 297	971 340	6	640 870	106 867	314 278	2 033 355	1.06
France	118 410	187 718	22 806	4 681 469	3 462 372	8 472 775	4	6 221 407	2 796 025	3 040 203	20 530 410	1.01
Germany	1 316 014	1 082 986	22 925	9 824 295	2 732 580	14 978 799	5	12 802 215	2 250 307	4 734 815	34 766 136	1.30
Greece	58 052	129 744	25 670	534 413	329 836	1 077 715	6	622 867	72 683	318 728	2 091 994	1.08
Hungary	38 753	60 049	10 006	251 296	253 159	613 264	8	460 174	72 588	168 948	1 314 973	1.36
Ireland	32 269	33 694	17 804	400 357	145 071	629 196	4	571 817	102 212	175 213	1 478 437	0.90
Italy	537 037	600 712	401 205	3 870 315	1 904 371	7 313 639	5	5 081 057	169 699	4 820 340	17 384 735	1.11
Latvia	6436	14 880	1306	27 441	12 711	62 774	5	99 810	21 721	30 597	214 903	0.97
Lithuania	8963	8780	2581	31 449	9938	61 711	3	115 910	39 712	31 261	248 594	0.75
Luxembourg	4582	8293	627	59 746	29 439	102 687	4	60 723	41 319	30 120	234 849	0.55
Malta	817	1348	498	7714	9884	20 260	3	14 080	1165	11 140	46 646	0.68
Netherlands	126 000	193 079	16 798	2 174 600	288 905	2 799 382	4	2 781 602	557 599	912 671	7 051 254	1.18
Poland	101 656	314 960	11 630	513 845	298 155	1 240 246	5	1 597 574	533 564	561 867	3 933 251	1.03
Portugal	71 473	118 014	29 372	141 055	282 337	642 252	4	1 058 365	91 259	351 235	2 143 112	1.30
Romania	20 546	68 199	3134	158 524	222 534	472 937	9	803 769	119 766	152 038	1 548 509	1.18
Slovakia	34 599	84 097	4235	96 639	127 683	347 254	6	202 230	112 862	67 765	730 111	1.03
Slovenia	3952	8356	5400	91 949	53 555	163 212	5	154 566	126 916	73 538	518 232	1.47
Spain	864 251	504 313	290 529	2 141 670	1 734 181	5 534 944	6	3 205 636	534 071	2 373 813	11 648 464	1.13
Sweden	71 174	233 559	55 198	721 068	313 295	1 394 294	4	1 062 042	513 982	533 911	3 504 229	0.86
United Kingdom	194 945	1 377 068	56 558	3 313 326	1 336 878	6 278 775	3	8 095 221	1 386 307	3 130 825	18 891 128	0.98
TOTAL EU	3 801 513	5 528 713	1 120 266	31 857 045	15 149 973	57 457 509	5	50 223 799	11 755 588	23 912 240	143 349 138	1.11

A&E = accident and emergency; EU = European Union; GDP = gross domestic product.

with bladder cancer accounting for 3%. In Greece, Italy, Malta, and Spain, bladder cancer represented >4% of all total cancer costs, whereas in Ireland, the country with the lowest proportion, bladder cancer accounted for approximately 2% of total costs.

The health care cost of cancer was €57 billion (Table 3), with bladder cancer representing 5% of these costs. In Italy, bladder cancer accounted for 7% of total cancer care costs, whereas in Hungary and Ireland, it accounted for <3%. Figure 2 and Supplementary Figure 2 report the per capita

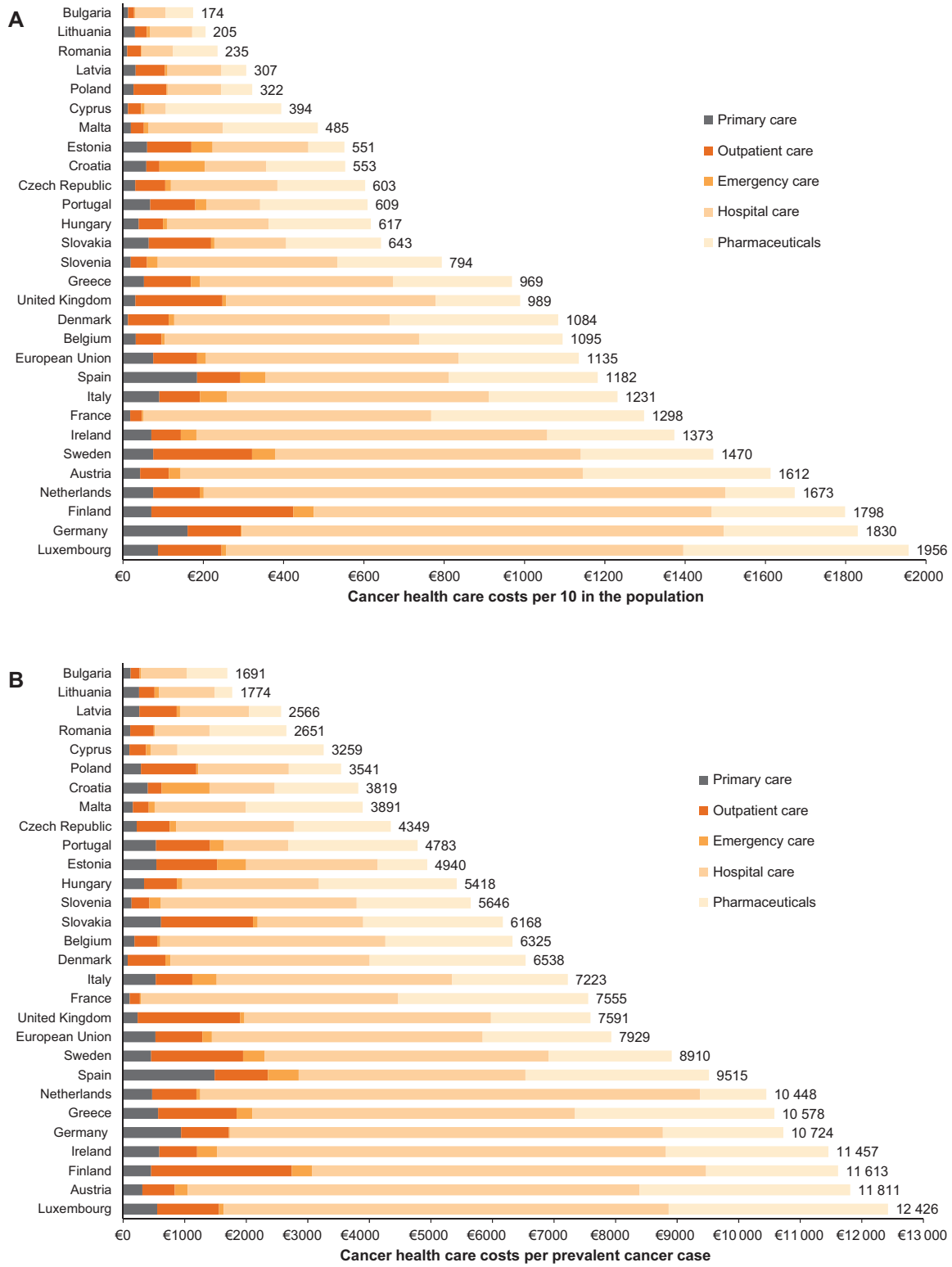

Fig. 2 – Total health care costs (€), not adjusted for price differentials, of cancer by health care service category (A) per 10 in the population, 2012, and (B) per prevalent cancer case.

health care costs attributable to overall cancer unadjusted and adjusted for price differentials, respectively.

4. Discussion

We estimated the total costs of bladder cancer to be €4.9 billion in 2012 across the EU. To our knowledge this is the first study to provide estimates of the economic burden of bladder cancer in the EU.

The annual health care expenditures due to bladder cancer accounted for €57 per 10 EU citizens or €6942 per prevalent case. The largest component of health care costs was inpatient care (€1.7 billion [58%]) followed by the costs of medicines (€0.6 billion [20%]). In the United States, inpatient and outpatient costs of bladder cancer were estimated at €3.2 billion in 2010 [16], which amounts to twice the expenditure per 10 US citizens relative to the EU (€97 PPP in the United States vs €45 in EU), after adjusting for price differentials. A similar ratio was found when health care costs were estimated per prevalent case, adjusting for price differentials.

Some suggest [17] that this higher expenditure on bladder cancer might explain the lower age-adjusted MIR in the United States relative to the EU-28 countries as a whole (0.21 vs 0.27 deaths per incident case in 2012). However, when US mortality statistics are compared with European countries with similarly high national incomes, these differences disappear (eg, 0.15 in Germany, 0.34 in France, and 0.23 deaths per incident case in Sweden) [2]. As a result, some researchers have questioned the effectiveness of higher US spending and suggested it is driven by higher costs, unnecessary testing, and unproven medical procedures [18]. The debate continues on whether higher spending in the United States results in better cancer outcomes [19] and how these can be best measured [20].

Large variations in bladder cancer health care costs were also found between European countries, ranging from €8 per 10 in the population in Latvia to €94 per 10 in the population in Luxembourg. Although these differences narrowed after adjusting for price differentials across countries, important differences persisted. In our analysis, the most important predictor of bladder-related health care costs was per capita national income, which explained higher unit costs in richer countries. For example, according to Eurostat, average annual salaries in human health and social work activities in Bulgaria were €4660 as opposed to €35 434 in Sweden, which could explain the large differences in the unit costs (eg, in Bulgaria a visit to a specialist was found to cost €20 as opposed to >€300 in Sweden).

However, even for countries with the same levels of wealth, health care costs on bladder cancer varied widely. For example, even though France and the United Kingdom have similar levels of per capita gross domestic product, France's expenditure on bladder cancer–specific health care was considerably higher than that of the United Kingdom. Differences in health care expenditures due to bladder cancer could be explained by health system configuration (eg, the number of hospital bed days due to bladder cancer in Germany is substantially higher than in Sweden). Substantial variations in pharmaceutical expenditure could also be explained by a myriad of factors such as differences in the introduction and use of new drugs, differences in the prices paid for the same drugs, increased pharmaceutical consumption in some countries; differences in the types of medication consumed, different price setting and reimbursement mechanisms, or variations in clinical practice. The patterns explaining the between-country differences in bladder cancer expenditure should be researched further.

It is then important to identify the most efficient public policy initiatives and health care systems capable of achieving the best cancer outcomes so that benchmarks can be set up across the EU member states. More research is thus required on factors affecting access to treatment and diagnosis and on biologic differences so that gender differences in the incidence and mortality of bladder cancer across the EU can be explained [21]. More EU research is needed to address intelligence gaps concerning the effectiveness and cost effectiveness of existing management and surveillance technologies for bladder cancer so that best practices can be based on robust evidence [22].

Bladder cancer contributed to 3% of the total cancer costs (€143 billion) in the EU in 2012. Luengo-Fernandez et al (2013) [1] found that of the total economic cost of cancer in 2009, 44% was due to lung (15%), breast (12%), colorectal (10%), and prostate cancers (7%). Of total health care cancer costs in 2009, prostate cancer accounted for 11%, which is considerably higher than that identified in this study for bladder cancer (5%). However, according to the IARC, the prevalence of prostate cancer is three times higher than that of bladder cancer in the EU [2], suggesting that the health care cost per prevalent cancer is higher for bladder than prostate cancer. Using the same methodology and sources as that used for the 2009 analysis, we estimated that the cost per prevalent bladder cancer was €5621 in 2009 compared with €4282 for prostate cancer. These findings are supported by research in 2011 estimating health care costs of bladder cancer per patient to be higher than prostate cancer across all disease phases [16].

Cost-of-illness data describe the magnitude of public health problems and allow comparisons across different types of cancers, diseases, and countries. If performed consistently over long periods of time, these types of analyses will aid prioritising health care resources and research funding towards diseases with the highest burden, identify the largest components of costs (eg, inpatient services), and provide valuable data to support economic evaluations of health care technologies. They can also provide evidence to assess whether at the population level, cancer care policies, such as increases in pharmaceutical expenditure, cost containment plans, and screening programmes, are translated into changes in cancer-specific health care costs, which then in turn can be evaluated against changes in outcome or non–health care cancer costs. Hence such data can aid decisions about the allocation of EU resources including service provision, prevention strategies, and future research funding [23].

We estimated the costs of cancer to increase from €126 billion to €143 billion between 2009 and 2012 across the EU-27 countries included in both analyses. According to the IARC and Eurostat, cancer incidence and mortality increased by 7% and 2%, respectively, in the same period. This translated into the number of working-years lost due to premature death increasing by 7.4 million years and days lost due to absence from work increasing by 2.1 million. These, together with changes in employment rates and wages, led to an increase in lost earnings due to cancer-related early death and absence from work of 18% (€9.5 million). In terms of health care resource use, a decrease was observed across most care categories. For example, reported cancer-related inpatient days were 8% (4.6 million days) lower in 2012 relative to 2009, without any discernible increase in informal care costs (€23.2 billion in 2009 vs €23.9 billion in 2012). However, the reduction in cancer-related health care resource use was counter-balanced by a significant rise in health care price inflation and the introduction of newer and more costly technologies that resulted in an overall increase in health care costs of €5.9 billion (12%).

This analysis has limitations. Despite the need to improve and standardise disease and resource use data across the EU [24], this remained largely unchanged between 2009 and 2012. For example, we used >150 sources for this study, and with the exception of inpatient days, national data were largely absent on the number of primary care, outpatient care, and A&E visits due to cancers and bladder cancer, requiring assumptions and extrapolations to estimate these. We provide a grading system here for each resource use and unit cost used regarding the quality of the sources available (Supplementary Table 1 and 2). Due to data availability, we did not consider other types of drugs, such as antiemetic drugs. We also found a lack of detailed prospective studies of cancer patients and national linked databases ascertaining medication expenditure by type of cancer and disease phase. As a result, the proportion of country-specific cancer-related pharmaceutical expenditures due to bladder cancer medication was ascertained using estimates from two countries (Germany and the Netherlands), which were then applied to the remaining countries. However, a sensitivity analysis showed alternative assumptions to result in changes of only 5% on total bladder cancer costs. Finally, our absolute costs are likely to be an underestimate. Some categories of health care costs, such as public health activities and screening programmes, long-term morbidities resulting from cancer treatments amongst survivors, and care provided outside the health care system (eg, hospices based outside hospitals), is not recorded for all countries under study. However, the estimates of the proportion of total cancer costs that were due to bladder cancer are less likely to be affected because these were also missing across all cancers.

5. Conclusions

Our study is the first to quantify the economic burden of bladder cancer in the EU and its contribution to total cancer costs. Urologic services are key cancer-specific pathways in EU countries, and bladder cancer makes up a significant burden on these systems. We believe that our study will be of particular interest to European policymakers implementing affordable cancer care for all European citizens. Our study updates and adds cost data to inform evidence-based policy making.

Author contributions: Ramon Luengo-Fernandez had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Leal, Luengo-Fernandez.
Acquisition of data: Leal, Luengo-Fernandez.
Analysis and interpretation of data: Leal, Luengo-Fernandez.
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Statistical analysis: Leal, Luengo-Fernandez.
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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.eururo.2015.10.024.

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