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Improving Efficiency and Resource Allocation in Future Cancer Care

EXECUTIVE REPORT

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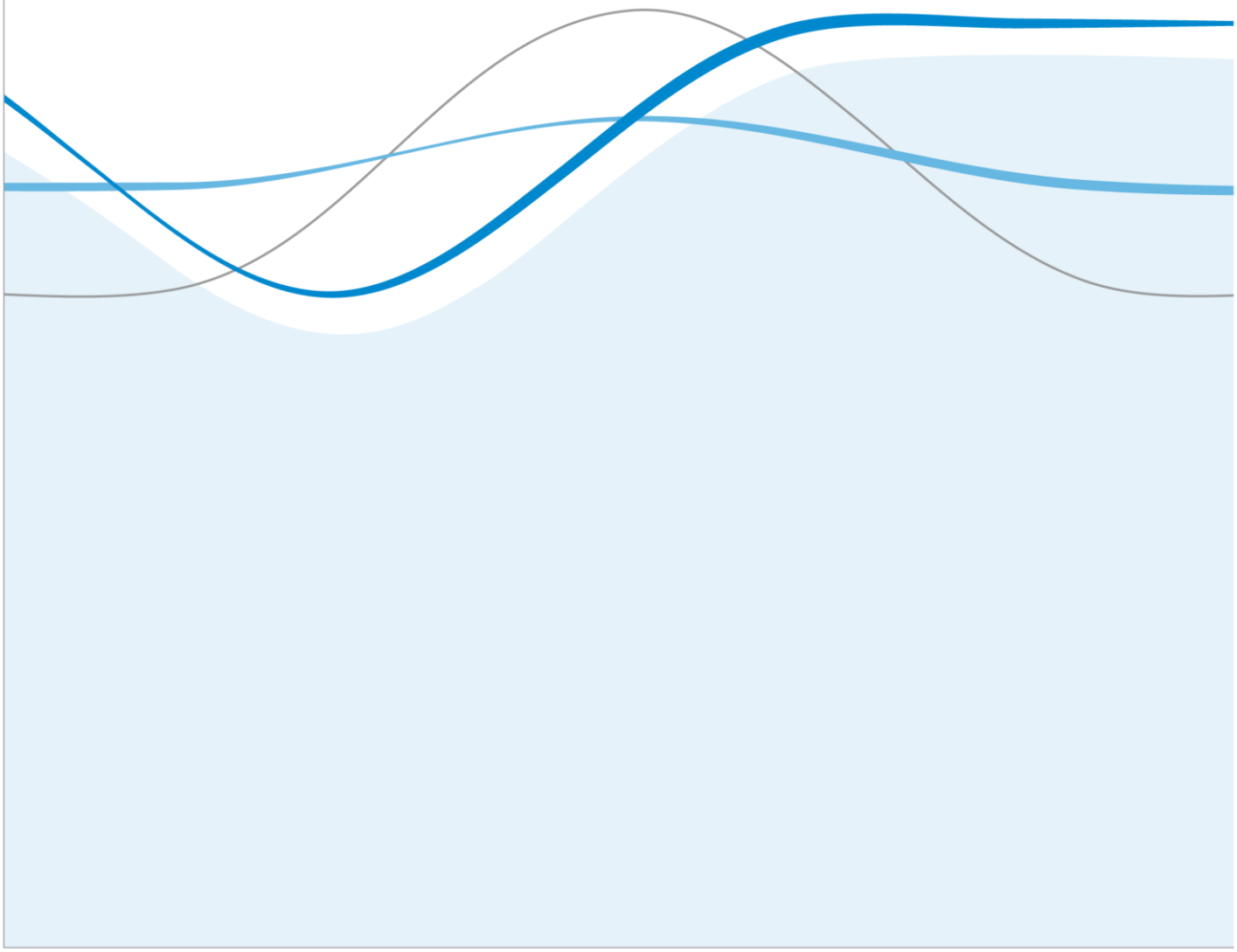

Improving Efficiency and Resource Allocation in Future Cancer Care

EXECUTIVE REPORT

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FOREWORD

The primary purpose of this report is to collate and examine the evidence regarding efficiencies and inefficiencies in cancer care in Europe, specifically considering whether health care systems are utilising their resources in the best possible way, and whether (and where) there are opportunities to create savings or efficiencies by reallocating resources. The report undertakes a synthesis of the evidence base regarding health care expenditure, health care outcomes and health care interventions specific to cancer control and cancer care in Europe.

We are grateful to Bristol-Myers Squibb (BMS) for commissioning this report. The authors remain solely responsible for the content and the conclusions.

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EXECUTIVE SUMMARY

The economic burden that cancer poses on our society is staggering – 25 million years of healthy life lost, at cost of €126 billion including €52 billion in lost productivity – and continues to grow with the ageing of the population. It is imperative, in light of growing financial pressures on our health care systems, that we find ways to make the best use of available resources to deliver high quality cancer care to patients.

This report explores possible ways to make this happen. Built on qualitative and quantitative research for nine countries and the European Union as a whole, it provides a comprehensive overview of the costs of cancer, the health burden (both morbidity and mortality) and resources devoted to its care, culminating in case studies of where efficiencies could be made across the system.

Future cancer care needs to deliver better outcomes to patients by making the best use of available resources.

INTRODUCTION

Cancer is the most common cause of death and morbidity in Europe after cardiovascular disease – and causes the equivalent of 25 million years of healthy life lost due to ill-health, disability and death across the European population (Murray et al., 2015). The economic burden of cancer is also substantial and has been estimated at **€126 billion in the European Union (EU) every year** (Luengo-Fernandez et al., 2013). With the ageing of the population and changing lifestyles, the prevalence of cancer and the consequent demand for cancer services is predicted to increase further – and with it, the burden on patients, their families and society in general (World Health Organization, 2016).

At the same time, financial constraints on healthcare systems have focused the attention of governments on ways to cut costs – and access to some of the most basic forms of cancer care, not to mention new treatments and diagnostics, is often not available or restricted, with significant inequities in access arising as a result.

Within this context, this report tries to address the following question: how can we best use available resources for cancer care to obtain the best outcomes possible for cancer patients? Or put differently, how can we make the most efficient use of resources within cancer care – where efficiency is not merely measured in terms of potential cost savings, but in terms of the value derived by both patients and society from given investments across all aspects of cancer care.

To help provide a comprehensive starting point to address the above questions, the report looks at a number of questions in turn:

- **What is the current burden of cancer?**
- **How much do we currently spend on cancer, and how much do we spend relative to other chronic conditions?**
- **What are opportunities to create greater overall efficiencies and reduce inefficiencies in cancer care?**

It is hoped that this compendium of evidence will help inform future debate on how to focus resource allocation towards practices that have the greatest impact on patient outcomes and may help reduce inefficiencies within cancer care and beyond.

A few notes on the methodology used in the development of the report

- Findings are based on both **qualitative and quantitative analysis** research, using a combination of literature reviews, consultation of experts, and our own economic analyses.
- **For each piece of evidence provided in the report, we have used the most recent set of available data, which allows for comparative analyses across Europe.** As a result, the reference years for different pieces of information featured in the report may vary.
- This report aims to present a European overview of existing evidence but also looks at country-level data from **9 countries:** Belgium, Denmark, France, Germany, Italy, the Netherlands, Poland, Sweden, and the United Kingdom (UK).
- **To allow for comparability across countries, country-level data have been adjusted for purchasing power parities (PPP)** – a common technique in economic research to make sure differences in individual countries' are not confounded by different spending levels within each country.
- **All cost estimates have been inflated to 2015 prices.**
- **The burden of cancer and other conditions is reported in DALYs (disability-adjusted life years).** DALYs are a widely used measure that incorporates both the impact of mortality (death) as well as morbidity (ill-health) on individuals (World Health Organization, 2002). They provide information on burden at a population level.[1]
- **Health care expenditure data** were sourced from either peer-reviewed publications or official public data sources such as EuroStat, the official statistics database for the EU. The main source of data for the costs of cancer was a study by Luengo-Fernandez et al. (2013), for which the data relate to 2009. Whilst prices have been inflated to 2015 in calculations of economic burden, the fact that the original estimates date back to 2009 should be taken into consideration. In addition, the methodology used in that analysis uses a bottom-up (rather than top-down) costing approach,[2] which is known to lead to under-estimates of total costs. **As a result, compared with other sources, the direct health care costs for cancer may be underestimated in this report. However, the estimates from the above-mentioned study were used as they allow for robust comparisons between cancer types and with other major diseases, which was a key ambition of this report**.
- **Examples of areas where potential efficiencies could be made in cancer care were obtained from consultation with health economic experts from a number of countries**, who completed a detailed pro-forma. These findings were complemented with a review of the published literature.
- **The potential savings and health gains from smoking cessation and biosimilars (presented at the end of the report) are based on modelling** – and assumptions used in these models are described in detail in the full report.

To access the full report, click here.

[1] DALYs are thus a composite score that considers both the number of years lost of healthy life because of someone dying early and/or experiencing poor quality of life because of their condition.
[2] A top-down costing approach divides the total expenditure on a service by units of activity (e.g. the cost per cancer patient). A bottom-up approach is more comprehensive and involves more detailed costing of all the elements used to cost the service. The different resources used to deliver the service are identified and a value is assigned to each (e.g. the cost of an outpatient attendance by a cancer patient, the cost of an inpatient stay for a cancer patient), these values are then summed and linked to an appropriate unit of activity to generate the unit cost.

CANCER: A SIGNIFICANT BURDEN TO OUR SOCIETIES

Despite advances in diagnosis and care and improved prognosis over the past few decades, cancer continues to represent a considerable burden on our societies, accounting for 25 million years of life lost due to ill-health, disability and death in the European Union every year (Murray et al., 2015).

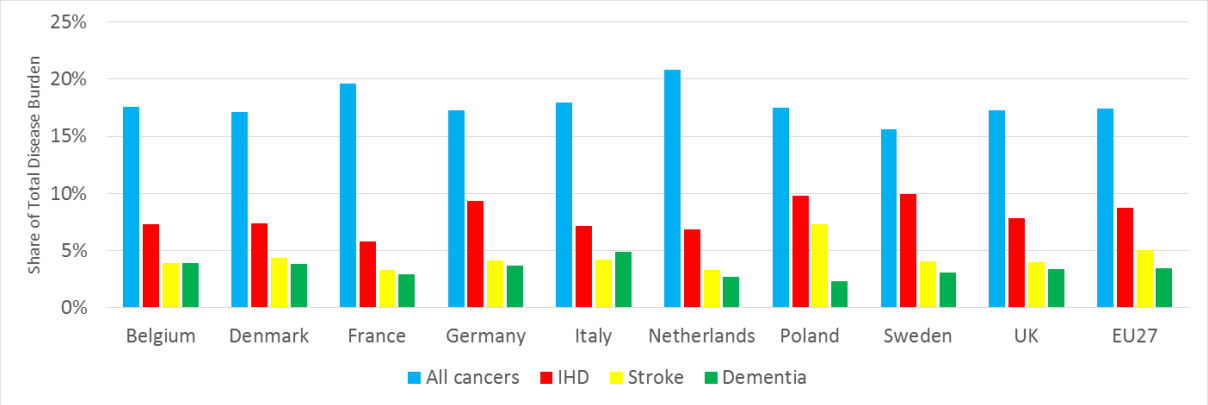
The ageing of the population and the adoption of certain lifestyle factors have contributed to a growing prevalence of cancer in Europe – even if the incidence for certain cancers, for example breast cancer, is decreasing in some countries due to advances in screening and earlier diagnosis.

In addition, cancer is, in the case of many patients, becoming a chronic condition. This has two important implications. Advances in diagnosis and treatment have transformed how many patients live 'with and beyond' their cancer, allowing them to live for many years with good quality of life and return to active, productive lives. However, at the same time, many cancer patients who have 'survived' their active treatment still require care and support, and are often dealing with other long term conditions**. This evolution in the nature of cancer thus has important implications for the way we consider the distribution of resources towards cancer care.**

Cancer represents 17% of the total burden of disease in Europe (EU27) as measured in DALYs – double the share of ischaemic heart disease, over three times that of stroke and five times that of dementia.

This proportion varies somewhat between countries, as does its relative share compared to other conditions – this is illustrated in the figure below.

Relative share of total disease burden for all cancers, ischemic heart disease (IHD), stroke and dementia in 2013 (measured in DALYs)



Cancer is not just a health care issue

Whilst most policy discussions focus on the direct costs of cancer to our healthcare systems – data suggest that the economic burden of cancer reaches far beyond the confines of the healthcare system, with non-health care costs accounting for 60% of the total cost of cancer (Luengo-Fernandez et al., 2013). Limiting our focus to direct costs of cancer thus underestimates the toll it places on our society.

Luengo-Fernandez et al.'s analysis of the total economic burden of cancer in Europe found that non-health care costs associated with cancer accounted for the majority of the total cost of cancer. These included productivity losses (€52 billion per year) and informal care (€23 billion per year). By comparison, direct health care costs amounted to €51 billion.

Using those figures as a starting point and adding the costs of long-term care and unpaid work through volunteering and care giving, cost analyses were performed for 9 countries. Findings are presented for Germany as an example in the table below (results for other countries are presented in the data compendium).

Cost distribution for cancer in Germany, all cancer types combined

	Costs included	Total costs per year	% of total economic burden of cancer
Direct health care costs	Primary care, outpatient and inpatient care, emergency care, long-term care and drug costs	€16.85 billion	40%
Production losses	Loss of paid work for patients because of their condition in terms of morbidity and mortality[3]	€15.02 billion	35%
Informal care	Costs of caregivers providing support to cancer patients	€6.97 billion	16%
Unpaid work	Loss of unpaid work which would normally be undertaken by patients (e.g. caregiving and volunteer work), loss due to mortality only	€3.50 billion 411 million hours (59% of which are in the voluntary sector)	8%
Total costs	All of the above	€42.34 billion	100%

Although the exact distribution across the above components varies between countries, key findings emerged across several countries:

- **The direct costs of cancer to the healthcare system represent less than half of the total costs of cancer** – from 27% of total costs in Denmark to 42% in Italy
- **Of the four main cancer types (lung, breast, colorectal and prostate), lung cancer has the largest economic burden**
- **In all countries, cancer causes a considerable labour market fall out** – and the costs associated with this lost production account for between a third and half of the total economic burden of cancer depending on the country.

[3] Please note our analysis only included unpaid work related to mortality, not morbidity, from cancer.

The evidence is clear that cancer is not just a health care issue, it is a societal issue impacting far beyond an individual patient.

How does the amount spent on cancer compare to other conditions?

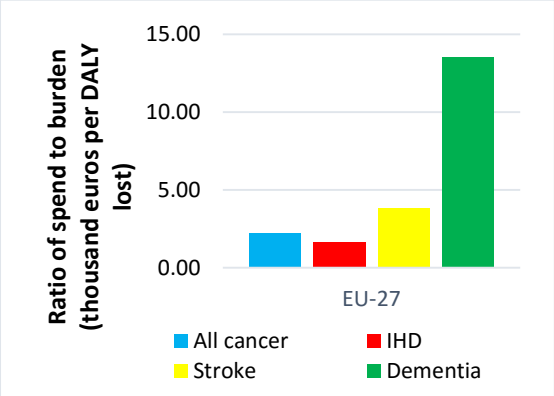
Across the EU, approximately 5% of all health expenditure goes on cancer, although this varies between countries.

We compared the ratio of health expenditure to disease burden (as measured in DALYs) for cancer compared with three other conditions: ischaemic heart disease, stroke and dementia.[4]

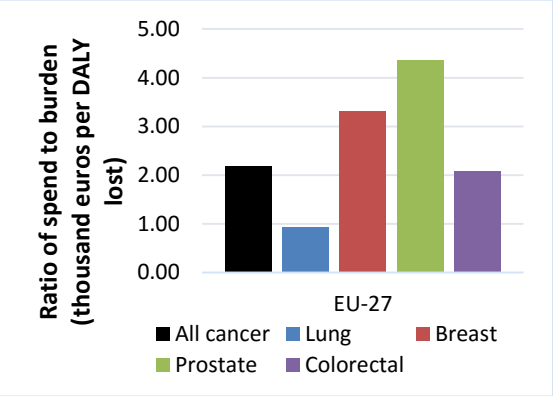
Overall, this analysis suggests that the relative amount spent compared to its burden is lower for cancer than for some of the other chronic conditions studied (left hand figure below).

There are, however, significant differences in terms of how much is spent on each cancer type relative to its burden – with the spend to burden ratio, for example, being much lower for lung cancer than for breast, prostate or colorectal cancer on average (right hand figure below).

Spend relative to disease burden (thousands Euros per DALY lost) by disease; EU27 average



Spend relative to disease burden (thousands Euros per DALY lost) by cancer type; EU27 average



In addition, the amount spent on cancer relative to its burden (measured in DALYs) differs substantially between the countries studied. The figure below illustrates how the ratios for each country for lung, breast, prostate and colorectal cancer compare to the EU average. Each country ratio has been standardised against the EU average, using the EU average (as presented in the graph above right) as a reference.

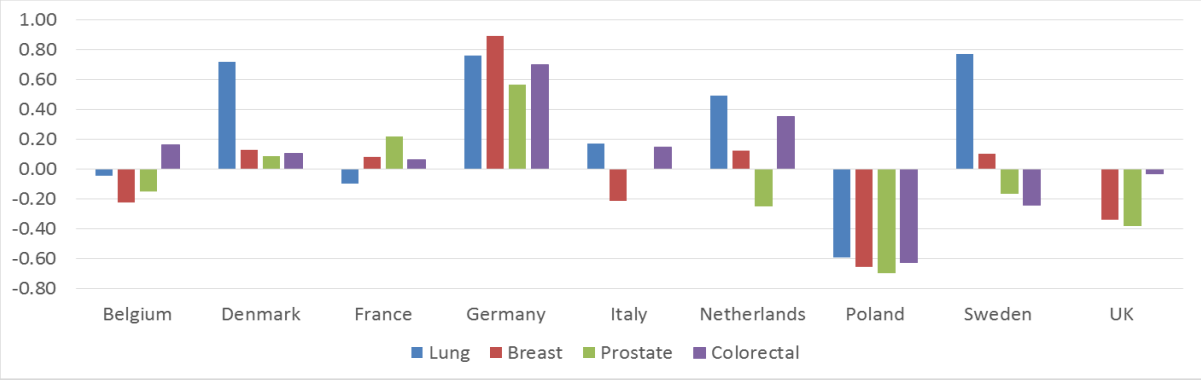
[4] This estimate is subject to the limitations of the data described in our methodology described above (cancer costs may be underestimated). However, this underestimation is similar across the tumour types and conditions included in the analysis, as the same methodology was used to capture costs in each case.

To interpret this graph:

- bars below the line suggest less spend relative to burden compared to the EU average
- bars above the line suggest more spend relative to burden compared to the EU average
- countries where no bar is visible (e.g. Italy for prostate cancer or the UK for lung cancer) indicate that the spend to burden ratio is the same as the EU average.

These comparative ratios do not assume that the EU average is the 'ideal', just a reference. For example, we see that Poland spends much less than the EU average given its cancer burden, while France spends more than the EU average given its burden in all cancers except lung cancer. Denmark and Sweden spend more than the EU average given their lung cancer burden.

Spend relative to disease burden compared with the European average for each tumour type. A negative number indicates lower spend to burden ratio than the EU27 average.



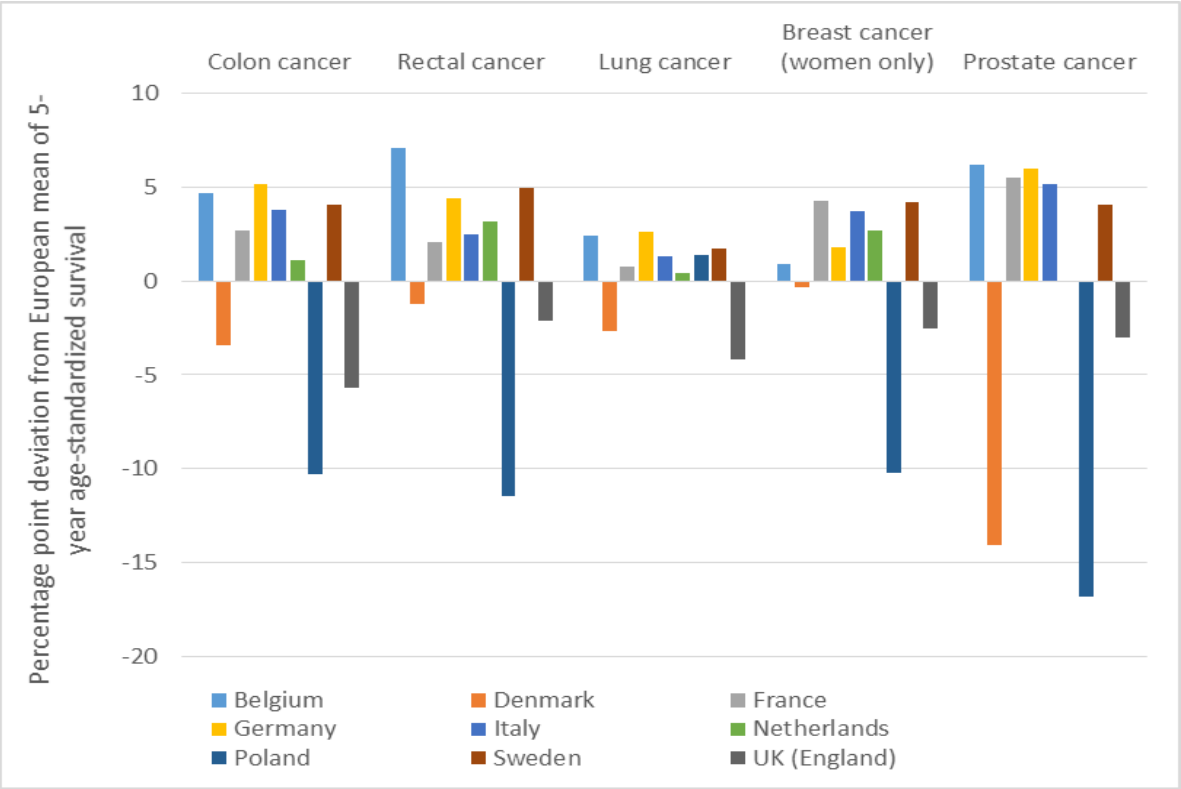
Note: the EU27 average spend relative to disease burden for lung cancer is 0.92; breast cancer is 3.31; prostate cancer is 4.37; and colorectal cancer is 2.08.

Is current expenditure on cancer achieving the best possible outcomes for patients?

Although survival rates are generally high for cancers in Europe, there are considerable differences in survival rates from different cancers between EU countries, suggesting room for improvement.

Using the most comprehensive set of European cancer survival data, the Eurocare-5 study, it was found, for example, that the UK and Denmark have worse five-year survival rates relative to the EU average for all five cancer types studied (colon, rectal, lung, breast in women, prostate) and Poland also has worse survival rates for all cancer types other than breast cancer in women (De Angelis et al., 2014).

5-year age-standardized relative survival for each country relative to the European average (De Angelis et al., 2014). A negative number indicates lower survival rates than the European average.



Note: the European mean 5-year age-standardised survival for colon cancer is 57.0; rectal cancer is 55.8; lung cancer is 13.0; breast cancer is 81.8; and prostate cancer is 83.4.

It should be noted that these data are illustrative and that relations of causality, for example comparing spending and outcomes, are complex and involve multiple factors. For example, it can be noted that whilst spending on lung cancer in Denmark is high relative to burden compared with the EU average, 5 year survival is poor. Further research is required to understand the relationship between these; whilst the efficiency of spending could be a factor, so too could other issues such as lifestyle factors and late diagnosis (noted to be important in Denmark, for example).

ACHIEVING GREATER EFFICIENCY: A KEY REQUIREMENT FOR THE FUTURE OF CANCER CARE

The large differences in the outcomes achieved for cancer patients across the EU as well as the inequalities in access to cancer care between countries suggest that much more can be done to improve how resources are devoted to cancer.

In fact, given the financial pressures on our healthcare systems coupled with the growing prevalence of cancer, finding ways to improve the appropriate allocation of existing resources to achieve the best possible outcomes for patients will be key to the sustainability of our healthcare systems.

This question is at the heart of the notion of **efficiency** – and concurs with the economic view that resources are scarce, and therefore need to be used in the most effective and efficient way possible.

It is important to note that 'efficiency' should not be viewed as synonymous with 'inducing cost savings': **what is critical is to achieve the best outcomes possible for patients within the resources available.**

What are the opportunities to create greater efficiencies in cancer care?

There is a strong desire across healthcare systems to identify areas where the efficiency of spending can be improved, and there are several examples in the literature where these have been quantified for health care in general. For example, in acute hospitals in England, it has been estimated that if variations across hospitals were eliminated, such that all hospitals performed in line with the best, £5 billion could be saved (Carter, 2016). Whilst the European Federation of Pharmaceutical Industries and Associations (EFPIA) estimates that non-adherence to prescription medicines costs around €125 billion per year in Europe and causes nearly 200,000 premature deaths (EFPIA, 2012). It is also estimated that reducing adverse drug reactions could lead to substantial savings (e.g. up to £466 million a year through reduction in bed days (Academy of Medical Royal Colleges, 2014)).

Further research is required to understand potential efficiency gains for cancer care specifically as there is a paucity of literature that quantifies such inefficiencies. We undertook to identify possible areas where efficiencies could be made in the planning, organisation, funding and delivery of cancer care – or conversely, where inefficiencies could be reduced and resources used more effectively.

Summary findings are outlined in the table below and then described in more detail thereafter.

Area of cancer care	Examples of where efficiency could be improved
Organisation and planning of services	1. The development and implementation of evidence-based National cancer control plans (NCPPs)
	2. The centralisation of cancer care into high-volume centres – this is particularly critical in the case of rarer cancers
	3. Using multidisciplinary care teams (MDTs) offering a person-centred approach to care
Prevention and early diagnosis	4. Integration of primary prevention strategies targeting alcohol consumption, smoking and obesity into health care pathways
	5. Implementation of quality screening programmes – particularly against breast, cervical and colorectal cancer
	6. Promoting early diagnosis of cancer with training of primary care physicians and provision of good diagnostic testing infrastructure
Treatment and care	7. Reducing inequalities in access to treatment, including innovative therapies
	8. Provision of appropriate care and support to patients beyond the initial phase of treatment
Greater efficiency in the assessment and uptake of new medicines	9. Reduced delays between regulatory approval and national-level access to new medicines through the use of managed entry agreements and greater exploitation of real-world evidence
	10. Prioritisation of interventions which offer the greatest value to patients and society – by considering the full societal impact of new medicines in Health Technology Assessment (HTA) and similar access decisions
Greater efficiency in the use of existing medicines	11. Appropriate use of generics and biosimilar versions of medicines when available

a) The development of national cancer care plans (NCCPs)

Although most countries have developed and implemented NCCPs, 20% have insufficient funds to implement them properly.

A core recommendation of policy frameworks on cancer - e.g. the 2009-2013 European Partnership for Action Against Cancer and the current European Joint Action on Cancer Control (CanCON) - is that all Member States should develop and implement comprehensive National Cancer Control Plans (NCCPs) as an instrumental tool to reducing mortality from cancer across the EU (EPAAC, 2015). However, it is believed

that only Denmark and France have been allocated specific additional funds for all aspects of their programmes (EIU, 2015).

b) Specialisation and centralisation of cancer care

Centralisation of cancer services into specialised centres is regarded as essential to ensure patients receive appropriate diagnosis and high-quality care, and thus achieve optimal outcomes – particularly for rare cancers.

Different countries have varying degrees of centralisation of cancer care, and in many countries, fragmentation of care has contributed to the inefficient delivery of care to patients.

In France, the notion of centralisation has been a priority in recent cancer care reforms. Since 2009, health care facilities must have specific permission issued by their regional health authority ('*Agence Régionale de Santé*') to treat cancer patients (INCa, 2015). They have to demonstrate that they meet minimum activity thresholds, measured in terms of annual activity levels for surgery, radiotherapy, and chemotherapy. In addition, networks linking regional cancer facilities have been established, with designated centres of reference and other accepted centres ('*centres de compétence*').

It should be mentioned that the evidence supporting the impact of centralisation of care on patient outcomes is mixed, with results often varying depending on the type of cancer and the national context of each study. However, centralisation of care in high-volume hospitals has been shown to be critical in the case of rare cancers, where it has a marked impact on patient outcomes.

c) A multidisciplinary, person-centred approach to diagnosis and care

Appropriately funded multi-disciplinary care teams are central to providing patients with person-centred care throughout all phases of their disease.

It is widely recognised that cancer care should ideally be organised around the individual needs of the patient, and delivered by a multidisciplinary care team which includes the appropriate combination of professionals to be able to address the physical, emotional and psychological needs of cancer patients along the entire care pathway.

Implementation of multidisciplinary care teams (MDTs), however, often falls short due to limited resources, embedded professional hierarchies, and lack of information exchange between professionals (KCE, 2015).

Belgium provides a promising example in this regard: The NCCP for Belgium calls for all cancer care programmes to have a multidisciplinary team available to support cancer patients, and provides specific remuneration to hospitals to fund extra manpower to fulfil key roles, including oncology nurses, psycho-oncologists, social workers and data managers. In addition, specialist oncology nurses coordinate the care and support for patients throughout all stages of care (KCE, 2015).

d) Integration of prevention strategies targeting alcohol consumption, smoking and obesity into health care delivery

Public health and health promotion efforts should particularly target more deprived populations, who have higher cancer incidence rates.

In England for example, if socio-economically deprived groups (that is the most deprived) had the same incidence rates as the least deprived, there would be 15,300

fewer cancer cases per year (of which 11,700 are lung) and 19,200 fewer deaths (Independent Cancer Taskforce, 2015).

e) Implementation of quality screening programmes – particularly for breast, cervical and colorectal cancer

There are significant differences in levels of uptake of all three types of cancer screening programmes between countries – for example, only 21% of Polish women had cervical cancer screening (Ministerstwo Zdrowia, 2015) as compared to 80% of Swedish women in 2013 (Eurostat, 2016).

Although there is some debate as to the impact of screening on reducing mortality rates, particularly for breast cancer, greater uptake of high-quality screening programmes is likely to have a positive impact on the burden of cancers amenable to screening in future, particularly if screening tests become more advanced and greater risk stratification is achieved for target populations. Note that the European Commission's *Action Against Cancer* (European Commission, 2009) targets achieving 100% population coverage of screening for breast, cervical and colorectal cancer.

f) Earlier diagnosis

Training of primary care physicians (GPs) and provision of good diagnostic testing infrastructure are key to allow for early and accurate diagnosis of patients presenting with any possible cancer symptoms.

In England for example, 38% of lung cancer cases, 25% of colorectal cancer cases and 4.6% of breast cancer cases present as an emergency presentation – often at an advanced stage where prognosis is already severely compromised (Elliss-Brookes et al., 2012). This late diagnosis has a detrimental impact on survival. For example, one-year survival for patients diagnosed through emergency presentation for lung cancer is 11% as compared to 28.6% for patients identified through other routes of diagnosis (Elliss-Brookes et al., 2012).

To try to improve early diagnosis of cancers by GPs, the National Institute for Health and Care Excellence (NICE) has developed guidance on 'Suspected cancer: recognition and referral' to help improve recognition and referral of suspected cancer cases. Also, infographics have been distributed to GPs in England and published in the *British Medical Journal* (Stahl-Timmins, 2015).

g) Reducing inequalities in access to care – for example, ensuring greater use of radiotherapy in accordance with evidence-based recommendations

One area of treatment which is known to be under-utilised for many cancers is radiotherapy – there is wide variability in access to radiotherapy machines between countries and median utilisation across Europe is 70% of optimal usage as predicted by evidence-based estimates (Borras et al., 2015).

Under-provision of radiotherapy is a significant problem globally – and a recent analysis suggested that scaling up radiotherapy capacity from 2015-2035 could result in a net monetary benefit of up to $239.3 billion in upper-middle income countries alone (equivalent to €217.5 billion), and save the equivalent of 10.7 million life-years (Atun et al., 2015).

h) Provision of appropriate care and support beyond the initial phase of treatment

With a growing number of patients living longer with cancer, the care and support needs of patients beyond their initial phase of treatment need to be addressed in cancer care pathways.

For example, a recent UK report estimated that investing in appropriate follow-up care for cancer patients through personalised care planning may result in savings of €542 million per year, as supporting people with cancer beyond their initial treatment costs the NHS in England at least €1.8 billion per year, excluding end-of-life care (Macmillan Cancer Support, 2015). At least €168 million was spent on inpatient hospital care, when patients should instead be receiving long-term support and management which may have prevented the need for emergency hospital admissions.[5]

i) Greater efficiency in the assessment and uptake of new drugs

Significant delays between the time of regulatory approval by the European Medicines Agency (EMA) and national 'access' for patients are evidenced in many countries – frequently exceeding the recommended 180 day limit set by the European Commission.

Observed delays are due in part to different evidentiary requirements and processes for pricing and reimbursement, as well as HTA, and decentralisation of these decisions to the regional level in many countries (e.g. Italy and Spain). Delays in access may also result from certain practices, for example lack of integration of a new treatment into clinical pathways – and these access delays may thus also vary between cancer types within the same country.

Managed entry agreements are increasingly being explored as a way to provide early access to patients to promising new medicines, whilst providing an opportunity to collect real-world evidence of the impact of these new interventions on patient outcomes and the use of resources.

In addition, **early access schemes** such as the Autorisation Temporaire d'Utilisation (ATU) scheme in France have been shown to advance access to patients to given treatments by up to 3 years (Degrassat-Théas et al., 2013). A different approach, which is currently being piloted by the EMA, is the 'Adaptive Pathways' programme. This scheme involves the iterative expansion of license based on the collection of further data, often in real-world settings. It has the potential to provide earlier access to patients in the greatest need who are most likely to benefit.

Finally, HTA and similar agencies need to consider the full societal value of new medicines in their evaluation, that is not just clinical outcomes but also the impact on quality of life, lost productivity and caregiver time.

Better integration of patients' perspectives in HTA decisions is notably key to ensuring that new medicines that may meet patients' needs are prioritised.

[5] Original figures were cited in Pounds sterling and have been converted into Euros. The original figures were: £420 million of savings through appropriate investment in follow up care, £1.4 billion currently spent supporting people with cancer beyond their initial treatment phase, and £130 million spent on inpatient hospital care.

QUANTIFYING EFFICIENCIES TO BE MADE – CASE STUDIES OF SMOKING CESSATION AND INCREASING THE USE OF BIOSIMILARS AND GENERICS

As part of this report, we also performed a number of case studies to try to quantify the impact of possible measures that may help generate savings that could be reinvested within the healthcare system – and cancer care in particular, or achieve greater patient outcomes. These included: reducing smoking prevalence and increasing the appropriate use of biosimilars[6] and generics.[7]

Summary findings:

- A 25% reduction in smoking prevalence in the 9 target countries would result in total cost savings of €6 billion, of which the largest economic gains are from lung cancer treatment costs and production gains for individuals.
- Total savings of €7.1 billion could be made through increased generic and biosimilar competition in the oncology market – of which €4.5 billion are attributable to greater appropriate use of generics and €2.6 billion of biosimilars.

These two case studies are described in more detail below.

Case study: Quantifying the impact of reducing the prevalence of smoking

Tobacco use, particularly cigarette smoking, is one of the leading causes of cancer. Although most commonly thought of as being the main cause of lung cancer, there are in fact several other tobacco-related cancers (TRCs) (see table below).

A model was constructed using Excel 2013 to evaluate the impact on lung cancer of a 25% reduction in smoking prevalence in 9 target countries (note: similar percentage reductions have been seen historically in Europe (ONS, 2013)). Lung cancer was chosen as the main outcome of this model because it has the highest mortality rate of all tobacco-related cancers.

[6] It is important to note that this report in no way advocates the use of non-equivalent biosimilars or unsuitable generics – this model is a mere simulation of the impact of an increased use of biosimilars and generics but the underlying assumption would be that only biosimilars and generics that conform to proper regulatory guidance for development are used.
[7] It should be noted that the report also looked at a number of other case studies of measures which may help either generate cost savings or improve patient outcomes.

Proportion of cancer cases attributed to smoking (Agudo et al., 2012)

Tobacco Related Cancer (TRC)	Attributable Fraction [a, b]
Larynx	84%
Lung	82%
Lower urinary tract	50%
Oropharynx	49%
Oesophagus	35%
Oral cavity	33%
Liver	25%
Stomach	21%
Colon and rectum	14%
Uterine cervix	14%
Pancreas	13%
Myeloid leukemia	13%
Kidney	8%

[a] The attributable fraction measures the public health burden of a risk factor by estimating the proportion of cases of a disease that would not have occurred in the absence of this risk factor.
[b] Estimates were adjusted for sex, age, education, body mass index, physical activity, alcohol consumption, total energy intake, and consumption of fruit and vegetables, assuming a population equally distributed by sex.

Because smoking is a known risk factor for lung cancer, fewer active smokers would be expected to result in lower lung cancer incidence and mortality. These health gains would translate into less health care use, less informal care and production gains in terms of both paid and unpaid work. It is important to note that a proportion of lung cancer patients are non-smokers/have never smoked, such that this intervention would not affect them.

According to the model, a 25% reduction in smoking prevalence in the 9 target countries would result in:

- 43,000 fewer cases of lung cancer (a 15-20% decrease in incidence) per year
- 36,700 fewer deaths from lung cancer (a 15-20% decrease in mortality) per year
- Over 600,000 life years gained per year
- Total cost savings of €6 billion, of which the largest economic gains are from lung cancer treatment costs and production gains for individuals.

It should be stated that the potential health gains and cost savings associated with a reduced prevalence of smoking will not be limited to lung cancer – as the incidence and mortality of other tobacco-related cancers, as well as other smoking-related diseases (e.g. other pulmonary diseases, cardiovascular and metabolic diseases) would also be expected to decrease.

What's more, better health for individuals who would otherwise have had lung cancer generates significant economic benefits for society in terms of production gains, increased unpaid work and reduced need for informal care.

Case study: Generating savings from greater appropriate use of biosimilars and generics

We also modelled the potential impact of increasing the appropriate use of both generics and biosimilars in oncology, using two particular products as examples.

A number of biologicals are moving off-patent in the next few years and a rise in the development of biosimilars is predicted. Some 22 biosimilars have been approved by the EMA in three classes: erythropoietins (EPOs), granulocyte colony-stimulating factors (GCSFs) and human growth hormone.

As with generics, one may assume that increased use of biosimilars upon patent expiry of their Reference Biologic Product (RBP) may result in savings for healthcare systems. However, the inherent complexities in the manufacturing, development and regulation of biosimilars entail several entry barriers – and there remain considerable uncertainties as to how the biosimilar market may develop in years to come.

As a result, the relative market share and price reductions observed with biosimilars are lower than with generics as a result.

Biosimilars have typically been priced 25-30% lower than their RBP (not counting rebates), whereas generics have led to price decreases of 70-80% by comparison (IMS Health, 2011; Grabowski, Guha and Salgado, 2014).

Countries have adopted different incentives to encourage biosimilar competition, and competitive performance varies both between countries and between products within countries as a result (see table below).

Incentives for biosimilars in different European countries (Grabowski et al., 2014)

	Germany	France	Italy	UK	Sweden
High generic usage	Yes	No	No	Yes	Yes
Quotas	Yes	No	Yes	No	No
Reference price system for biosimilars	Yes	No	No	No	No
Price relative to reference brand	Variable	Fixed	Fixed	Variable	Variable
Patient co-payments	Capped	Mixed	Mixed	No	Capped

A model was developed in Excel to estimate the potential sales of a biosimilar (from a targeted monoclonal antibody used in breast cancer) and a generic (from a tyrosine kinase inhibitor used to treat chronic myeloid leukaemia) using two possible scenarios: one based on expected market penetration and price reductions observed with biosimilars (scenario A), and one using similar estimates as observed with generics (scenario B), see table below.

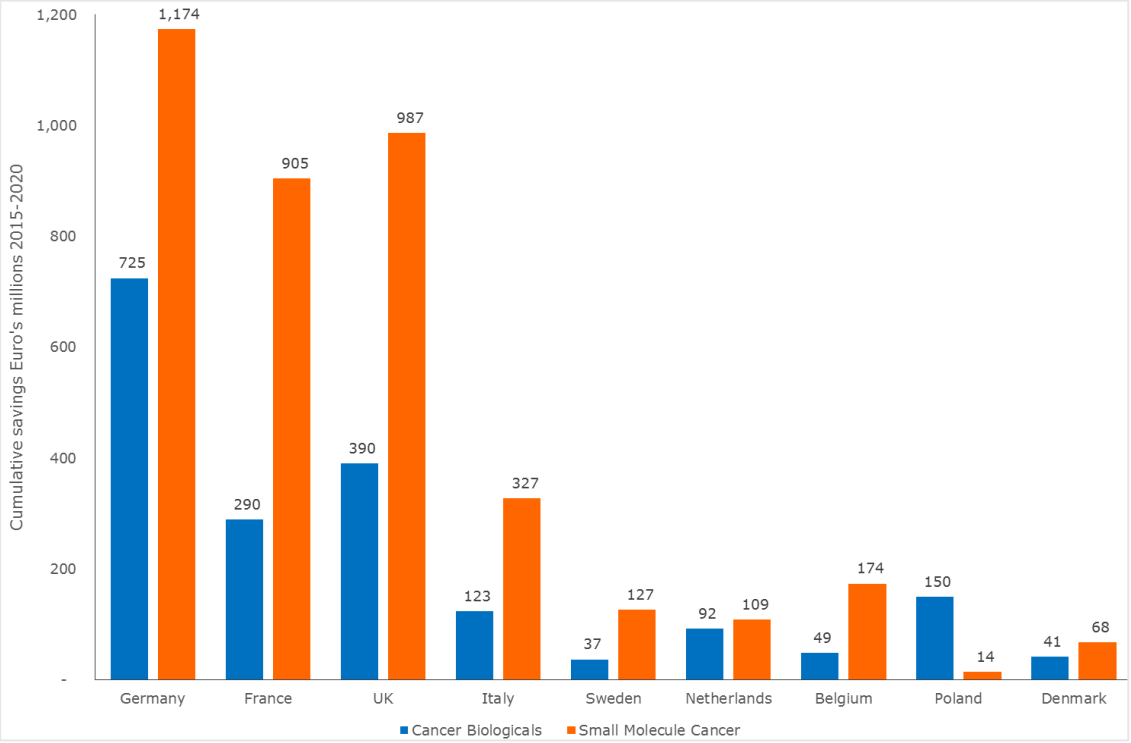
Scenarios used to model potential savings from generics and biosimilars

Baseline assumptions	Scenario A	Scenario B
Market share (%)	30%	60%
Price relative to protected original brand (without counting discounts)	75%	30%

Both scenarios yielded significant potential cost savings, however these varied per country and, as expected, were much greater for scenario B than for scenario A. For example, the model predicted that for the 9 countries in total annual potential cost savings of €90.8 million for the targeted monoclonal antibody could be achieved based on scenario A, and this figure rises to €508 million under scenario B. The corresponding results for the tyrosine kinase inhibitor were €66.5 million under scenario A and €372 million under scenario B.

This analysis was extended to look at all cancer medicines that are facing loss of exclusivity (LOE) due to patent expiry between 2015 and 2020 – encompassing 7 biologicals and 17 small molecule medicines in all. These products together represented total sales for EU26 of €15.8 billion in 2015 (ex-factory prices). Assumptions are therefore based on ex-factory (list) prices; in reality discounts are often applied to these list prices so that actual savings may be lower than estimated. The figure below shows the accumulative savings that are potentially achievable in each country.

Potential savings due to loss of exclusivity (LOE) for cancer medicines facing LOE 2015-2020, realised between 2016 and 2020, by country [Source: IMS Health, MIDAS 2015, GMI Adhoc Services]



It was estimated that total savings of €7.1 billion could be made through generic and biosimilar competition in the oncology market – of which €4.5 billion occur for generics and €2.6 billion occur for biosimilars.

An important note about biosimilars

Biosimilars are large molecules that are similar, but not identical, to their biological reference biological product (RBP) and have demonstrated equivalent safety and efficacy in patients. Because they too are derived from a biological synthesis, even a small deviation from manufacturing processes may alter them and cause potential adverse events in patients. Also, biosimilars need official approval when entering the market upon patent expiry of their reference biological product and the EMA has a specific pathway for assessing biosimilars, which is more complex than for generics. Finally, the issue of patient safety is also critical with biosimilars, and investment in high-quality outcomes and safety data collection is necessary to evaluate the impact of biosimilars on patient safety and efficacy over time.

CONCLUSION

The burden of cancer on our societies is growing, and in parallel, financial pressures on our healthcare systems are increasing, with many patients across Europe not receiving the care they need to achieve the best health outcomes.

This report was intended to explore the economic burden of cancer on our society – as well as investigate areas where more effective and efficient use of existing resources can be made. The report does not aim to answer the question of whether the amounts we are currently devoting to cancer are adequate – this depends on individual countries' available resources, prioritisation of cancer with respect to other conditions, and the societal value that governments and their populations place on different conditions.

This being said, the report does explore measures which could be taken to free up resources that could be re-invested within the system. The case studies provided are illustrative – and point to the fact that opportunities exist to increase funding for cancer care (and health more generally).

The past few decades have brought considerable advances for cancer patients – and yet the challenges remaining are real, especially as financial constraints on health care budgets drive greater inequalities in access to care both within and across countries. A solution lies in improving the allocation – and efficiency – of resources across the spectrum of cancer care, never losing sight of the goal to improve survival and outcomes for patients.

A key part of this solution is developing a better understanding of the economic data surrounding cancer. This report aims to contribute to this knowledge and hopes to move the debate forward – and help improve the care we offer cancer patients as a result.

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