An Analysis Of Whether Higher Health Care Spending In The United States Versus Europe Is ‘Worth It’ In The Case Of Cancer

ABSTRACT The United States spends more on health care than other developed countries, but some argue that US patients do not derive sufficient benefit from this extra spending. We studied whether higher US cancer care costs, compared with those of ten European countries, were “worth it” by looking at the survival differences for cancer patients in these countries compared to the relative costs of cancer care. We found that US cancer patients experienced greater survival gains than their European counterparts; even after considering higher US costs, this investment generated $598 billion of additional value for US patients who were diagnosed with cancer between 1983 and 1999. The value of that additional survival gain was highest for prostate cancer patients ($627 billion) and breast cancer patients ($173 billion). These findings do not appear to have been driven solely by earlier diagnosis. Our study suggests that the higher-cost US system of cancer care delivery may be worth it, although further research is required to determine what specific tools or treatments are driving improved cancer survival in the United States.

The United States spends much more on health care per capita than any European country, and the relative growth in US health care costs has exceeded that of most countries in the European Union as well. How much value this additional spending produces, in terms of better health outcomes or other benefits, is frequently debated, with some arguing that the United States fares the same or worse despite higher spending. But there has been little hard evidence to support either side of the argument.

In this paper we assess whether higher US spending on cancer care is “worth it.” Cancer is the leading cause of death in developed countries and is an important component of overall health care costs. In line with overall trends in US health care costs, US spending on cancer treatment has risen greatly over time, from $13.1 billion in 1980 to $72.1 billion in 2004. This exceeds costs and cost growth observed in Europe.

At the same time, previous epidemiological studies have suggested that survival prospects for US cancer patients are better than those for European patients. US mortality rates for cancer are lower than those in Europe, despite higher rates of cancer incidence in the United States. Five-year relative survival rates from cancer diagnosis appear to be higher in the United States, relative to Europe, for most solid tumors.

These studies, however, have left unanswered the question of whether these improved survival prospects are sufficient to justify the higher US costs. To address this question, we examined survival differences for cancer patients in the United States compared to a fairly representative group of ten European countries.

We calculated the financial value of these additional years of survival in US dollars and then...
compared them to the costs of cancer care in these countries. We found that the value of the survival gains greatly outweighed the costs, which suggests that the costs of cancer care were indeed “worth it.”

Study Data And Methods
We used survival data from large cancer registries in the United States and Europe to determine to what extent life expectancy increased, or decreased, for US and European patients during the time period studied. We then estimated the social value of these extra years of survival in US dollar amounts, using conventional approaches to valuing statistical lives.

Finally, we compared this dollar value to the additional cost of treating US patients, which we calculated using health spending data from the Organization for Economic Cooperation and Development. Throughout the paper we use the term value when discussing the incremental social value of higher survival and the term costs when discussing the costs of cancer care. If the value of higher survival outweighed the higher costs of care, we considered this support for our hypothesis that US cancer spending is worth the cost.

It was important to confirm that the survival differences we observed reflected real patient outcomes and not merely changes in the time of diagnosis. Increased screening and earlier detection can confer a “lead-time bias” that makes survival appear to be longer, without any actual improvement in life expectancy. As a result, we examined in a sensitivity analysis changes in population mortality rates in the United States and in Europe using data from the World Health Organization. These data show whether US cancer mortality rates fell faster than cancer mortality rates in the European Union from 1983 to 1999, or whether mortality rates were similar despite earlier screening and detection.

Cancer Survival
Survival data for patients diagnosed with cancer were obtained from the Surveillance, Epidemiology, and End Results (SEER) database for the United States and from the EUROCare (European Cancer Registry on Survival and Care of Cancer Patients) databases for countries in Europe. Beginning in 1973, the SEER database has been recording survival time, tumor characteristics, and demographics for individual patients enrolled in cancer registries across the United States, representing about 14 percent of the US population during the time period studied. The data are representative of the cancer experience in the broader US population for most cancer types.

For European countries, the EUROCare databases represent the most comprehensive source of cancer survival data available. Our study reviews publicly available data on cancer patients diagnosed between 1983 and 1999. More recent data, tracking patients through 2002, were not made available by the EUROCare steering committee.

Twenty-three countries are included in the EUROCare databases, but only ten reported data consistently over the 1983–99 period: Finland, France, Germany, Iceland, Norway, Scotland, Slovakia, Slovenia, Sweden, and Wales. Our analysis relies on these ten countries, which account for 36 percent of the total European Union population. Limitations of the EUROCare data are addressed in this study.

We examined survival data for patients diagnosed from 1983 through 1999 for thirteen cancer types for which data were consistently available from both the European and US survival databases: breast, prostate, colorectal, testicular, soft tissue, thyroid, stomach, uterine, melanoma, Hodgkin’s lymphoma, non-Hodgkins lymphoma, acute myeloid leukemia, and chronic myeloid leukemia.

We examined survival differences between the United States and Europe using two approaches. First, we looked at differences in the length of time from cancer diagnosis to death in the most recent time period available for analysis across both data sets: patients diagnosed from 1995 through 1999. Second, we examined differences in survival gains over time for patients diagnosed from 1983 through 1999.

The term survival gains refers to increases in years of life expectancy from cancer diagnosis seen over time. We decided to focus on examining survival gains over time because doing so provides insight into the progress that countries have made relative to their own baselines. An analysis that focuses instead on levels of survival is more likely to be influenced by intrinsic population characteristics, such as genetic predisposition to cancer, and might not reflect the impact of different health care systems.

Our survival analysis was based on a Cox proportional hazards model for each country, including as covariates the following: patient age groups, sex, geographic location, period of diagnosis, and interactions between geographic location and period of diagnosis. We also used another model that examined average survival rates across all cancer types, including similar covariates. We chose the Cox model because it enabled us to estimate full survival curves over patients’ lifetimes.

Value Of A Statistical Life
Prior studies have concluded that the value of a statistical life generally ranges from $5 million to $12 million.

for prime-age workers, ages 25–54.\textsuperscript{14} The statistical-life concept captures the value that people place on reducing the risk of mortality. Estimates are often based on data about the amount of income that people would give up in exchange for lower risk of mortality—for example, by choosing a less risky but lower-paying job.\textsuperscript{15} This value can also be expressed in terms of the value of an additional life-year.

A statistical life worth $5–$12 million equates to $150,000–$360,000 for each statistical life-year.\textsuperscript{16} We conservatively chose a value of $150,000 per life-year for our survival calculations.\textsuperscript{17}

COSTS OF CANCER CARE We collected data on total health expenditures in the ten European countries and the United States (1983–99) from the Organization for Economic Cooperation and Development.\textsuperscript{18} All costs were expressed in terms of US dollars according to purchasing power parity, which is the standard method for such an analysis.

We then calculated the costs of cancer care in each country by multiplying the country’s total health care expenditures by published estimates of the fraction of health expenditures devoted to cancer in each country. Details on these calculations, and total cancer costs per country, are available in the online Technical Appendix.\textsuperscript{19}

These costs include expenses associated with treatment, including radiation and drug regimens, as well as diagnosis, such as mammography and prostate-specific antigen screening. To estimate the average lifetime costs per patient in each year, we divided the country’s cancer care costs by the total number of new cancer patients diagnosed each year.\textsuperscript{20}

NET VALUE CALCULATIONS To calculate the value of survival gains in the United States relative to that in the European countries, we subtracted the additional costs of care in the United States from the value of additional US survival gains expressed as gains in years of life expectancy. The aggregate value for US cancer patients as a whole was then calculated using published estimates of the number of new cancer patients each year, by country.\textsuperscript{21}

COUNTRY-LEVEL CORRELATIONS The question of whether higher spending is attributable to improved survival is a complex one. We took several approaches, but we acknowledge that none is definitive. First, to gain some insight into the relationship between higher spending and survival improvements, we examined country-level associations between cancer survival and spending (see the Technical Appendix).\textsuperscript{19}

SENSITIVITY ANALYSIS: POPULATION MORTALITY RATES Next, we examined changes in cancer-specific population mortality rates in the United States and Europe. We used the World Health Organization Cancer Mortality Database to address the question of whether our conclusions are a result of earlier diagnoses and hence do not necessarily reflect improvement in life expectancy.

For example, if cancer cases are simply detected six months earlier, with no corresponding change in patients’ prognosis, it may still appear that survival from the date of diagnosis has risen by six months. This illusory gain in survival is known as lead-time bias. However, simply diagnosing people earlier would have no effect on the rate at which people die from disease.

By analyzing population mortality rates, which are insensitive to lead-time bias, we show that US cancer mortality rates fell faster than cancer mortality rates in the European Union. This must be due to real improvements in cancer survival (see the Technical Appendix for further explanation of this approach).\textsuperscript{19}

LIMITATIONS This study has several limitations worth noting. First, we did not examine the cost-effectiveness of individual cancer treatments or interventions such as breast or prostate cancer screening. Although our results suggest that survival gains associated with US cancer care have been worth the overall costs, this does not imply that all treatments are cost-effective. Additionally, we could not examine the extent to which better outcomes were the result of earlier diagnosis due to screening or newer treatments.

Although the databases we used are the most comprehensive and recent sources available, they might not represent the current experience of all cancer patients in the United States and in Europe. Important changes in cancer care have occurred in the past ten years, including the introduction of expensive new drug treatments and increased use of diagnostic imaging.

Additionally, whereas most of the European countries we analyzed are covered by national registries that include the full population of each country, coverage from France and Germany is based on regional registries, which might not
fully represent the experience of these countries. Furthermore, the cost data approximated the costs of cancer care in each year by dividing aggregate costs by the number of patients diagnosed in each year. But these estimates cannot exactly match the lifetime costs of care for a patient diagnosed in a particular year.

As we note, we focused on differences in improvements in cancer survival and population mortality, rather than on simple differences in survival or mortality levels across countries. The approach comparing differences in improvements in cancer survival is less likely to be influenced by intrinsic population characteristics that could affect patient outcomes, but it ignores the higher US survival levels at the beginning of our analysis period.

Finally, this study did not examine differences in morbidity or productivity associated with cancer, and thus these outcomes were not valued.

**Study Results**

**VALUE OF CANCER SURVIVAL** For cancer patients diagnosed during 1995–99, adjusted average survival was 11.1 years from diagnosis in the United States, compared with 9.3 years from diagnosis among the European countries—a difference of 1.8 years (Exhibit 1). This difference reflected higher US survival levels for most cancer types, with the exception of chronic myeloid leukemia, acute myeloid leukemia, Hodgkin’s lymphoma, and testicular cancer, for which the European countries experienced improved survival. All survival differences were statistically significant except for those for Hodgkin’s lymphoma and thyroid cancer.

Examining cancer survival gains from 1983 through 1999, US survival gains after cancer diagnosis exceeded survival gains experienced in the European countries for most cancer types. The greatest excess US survival gains were observed for prostate cancer, chronic myeloid leukemia, and acute myeloid leukemia, for which US patients gained an additional two years of survival compared to patients in the European countries. The European countries experienced greater gains in colorectal cancer survival—an additional 0.6 year—and uterine cancer survival—an additional 1.3 years (data not shown).

Exhibit 2 shows the estimated value of these survival gains (1983–99) by individual cancer type. The value of additional survival gain was highest for prostate cancer ($627 billion in excess US gains) and breast cancer ($173 billion in excess US gains). But these US gains were partially offset by higher European survival gains for several cancer types, including uterine cancer ($67 billion in excess European gains); colorectal cancer ($46 billion in excess European gains); and melanoma ($2.5 billion in excess European gains).

**COSTS OF CANCER CARE** Meanwhile, US spending on cancer care, in 2010 US dollars, increased from $47,000 per cancer case to $70,000 per case from 1983 through 1999—a 49 percent increase. In the ten European countries, spending on cancer care in 2010 US dollars increased from $38,000 per cancer case to $44,000—a 16 percent increase. Additional spending among US patients with the cancer types included in the analysis in excess of European costs thus totaled $158 billion over the period 1983–99.

**NET SOCIAL VALUE** Exhibit 3 shows the net value of US survival gains in excess of European survival gains from 1983 through 1999. Again, this represents the value of excess survival gains less the excess costs of cancer care. For an individual cancer patient, the net value of survival gain was $61,000 on average, ranging between $51,000 and $94,000 over the seventeen-year analysis period. The net value to all US patients with the cancer types included in the analysis was $598 billion, or approximately $43 billion annually. To put the aggregate net value to US patients into context, in 1999, $598 billion corresponded to approximately 36 percent of US health care spending in 2010 dollars.

**COUNTRY-LEVEL CORRELATIONS** Our examination of the correlation between cancer expenditures per capita over the period 1995–99 and average survival from cancer diagnosis over the same period suggests that for each $100 increase in spending per capita on cancer care, an
approximately $20,000 increase in spending per cancer patient was associated with an additional 2.3 years in life expectancy after diagnosis for the average cancer patient. This correlation was significant at the 5 percent level \( (p = 0.016) \). Approximately 47 percent of the variation in survival from cancer diagnosis was explained by variation in cancer spending (data not shown).

Our analysis of country-level correlations between changes in cancer expenditures per capita over the period 1983–99 and gains in survival over the same period suggests that each $100 increase in cancer spending per capita—approximately an additional $20,000 increase in spending per cancer patient—from 1983 to 1999 led to an additional survival gain of 1.0 year of life expectancy after diagnosis. The correlation was significant at the 10 percent level \( (p = 0.092) \). Approximately 28 percent of the variation in gains in cancer survival over the period was explained by a variation in changes in spending over the period (data not shown).

**SENSITIVITY ANALYSIS: POPULATION MORTALITY RATES**

To examine the effect of earlier diagnosis on the value of additional survival gains—the lead-time bias—we also looked at population mortality rates for cancer over time in the United States and in Europe, which are not sensitive to changes in the time of cancer diagnosis. According to this analysis, cancer mortality rates fell faster in the United States than in the ten European countries over a similar time period, 1982–2005.

For example, faster declines in population mortality rates in the United States corresponded to 222,000 prostate cancer deaths averted and 87,000 breast cancer deaths averted in that time period. Converting the declines in mortality rates into gains in life expectancy showed a gain of 1.8 years in life expectancy for prostate cancer patients and a gain of 0.8 years in life expectancy for breast cancer patients. This suggests that lead-time bias did not confound our results (see the Technical Appendix for further discussion).19

**Discussion**

The high costs of cancer care in the United States are frequently cited as evidence of a poorly functioning health care system, compared to those of other developed countries.25 Using conservative market estimates of the value of a statistical life, this study presented evidence that US cancer survival gains are worth more than the corresponding growth in the cost of US cancer care according to the most recent data available for analysis, 1983–99.26

Our sensitivity analyses demonstrated that our findings are probably not confounded by lead-time bias. Overall, we found that the United States generated more than $500 billion of additional value for cancer patients, net of its higher costs of treatment.

A key question for policy makers is whether the US survival gains are actually produced by
higher US spending on cancer care or by some other factor unrelated to the health care delivery system. The existence of a causal relationship from spending to survival seems plausible, because we analyzed the survival of patients who had already been diagnosed and had thus entered into treatment by the health care system. Thus, non–treatment-related investments by patients—in healthy behavior such as exercise and in other types of preventive activities—are likely to have a smaller impact relative to spending on cancer care delivery.27

Our analyses were consistent with the hypothesis that countries with higher growth in cancer spending also exhibit greater survival. For example, Slovakia spent $39 per capita on cancer care and averaged 5.5 years’ life expectancy from cancer diagnosis. Sweden spent $134 per capita on cancer care and averaged 9.9 years’ life expectancy from diagnosis. The United States spent $207 per capita on cancer care and saw 10.8 years of life expectancy from the point of diagnosis.

Differences in US costs also reflect—at least in part—more rapid uptake of new technologies that may lead to differences in survival. In prostate cancer treatment, several major changes were implemented in the United States in the 1980s and 1990s, including higher rates of radical prostatectomy; improvements in radiation therapy; and use of luteinizing hormone-releasing hormone agonists, a type of drug that causes testosterone levels to fall in men.28

Compared with the United States, European countries typically treated prostate cancer less aggressively, with lower use of these technologies during this time period.28,30 In addition, new cancer drugs often reach US patients sooner than their European counterparts,31 in part because of delays or denials of reimbursement decisions within Europe.

For example, the drug trastuzumab (Herceptin), a major breakthrough in the treatment of breast cancer,25 was approved by the US Food and Drug Administration in 1998 and was quickly incorporated into clinical practice guidelines.32 In contrast, trastuzumab was not launched until after 2000 in many European countries, including Finland, France, Germany, and Sweden.33 The National Institute for Health and Clinical Excellence in the United Kingdom, which evaluates the cost-effectiveness of new therapies to inform coverage and reimbursement decisions, did not recommend reimbursement and use of trastuzumab for breast cancer until 2002.34,35

Finally, earlier detection and management associated with increased screening for breast cancer through mammography, and for prostate cancer through prostate-specific antigen testing, in the United States relative to Europe also could have been responsible for improved US patient outcomes.34

In summary, our results indicate that the United States has experienced greater cancer survival gains and that the value of these additional gains exceeded the additional costs of care in the United States during the 1980s and 1990s. Our findings bear on the larger question of whether higher US health care spending is worth it, suggesting—although not confirming—that it is. Further research is required to examine the drivers of spending and their effects on outcomes, including assessing the relative contributions of treatments, screening, the skill of health care personnel, and other factors in improving patient outcomes. Additionally, we believe that similar studies targeted toward other disease areas and incorporating newer data when available will be required to shed further light on this broad and timely question. ■
NOTES


8 More recent SEER data represent 28 percent of the US population; however, for the time period examined in this study, the database represented 14 percent of the US population.

9 Lung cancer and colorectal cancer have been shown to be underreported in SEER compared with the national experience.


12 Age groupings (in years) were those available in the EUROCare databases: 15–44, 45–54, 55–64, 65–74, and 75–99. Periods of diagnosis were those available in the EUROCare databases: 1983–85, 1986–88, 1989–91, 1992–94, and 1995–99. Location was a binary variable in the main analysis, indicating whether an observation came from the United States or Europe. Aggregate EUROCare data on number of patients who died or were lost to follow-up in each year were converted to individual-level observations.

13 To test the sensitivity of our results to our model choice, we compared estimates of survival differences at five years obtained using the Cox proportional hazards model to estimates of differences in relative survival at five years—a method frequently published in the peer-reviewed oncology literature. Survival differences at five years between the United States and Europe using the Cox model were similar to estimates of differences in relative survival between the United States and Europe using a five-year relative survival period analysis. The Cox model produced greater differences between survival rates in the United States and in Europe only for melanoma, stomach cancer, and testicular cancer. For details on the period relative survival approach, see Note 7.


17 We used a discount rate of 3 percent and used 1999 as the reference year.

18 When country-level health expenditure data were not available for every year, estimates were extrapolated geometrically using the available data for that country. To account for cases when survival data from the registry of a European country represented a subset of the country’s cancer cases, the relative contribution of the country’s registries to the survival analysis was used to weight average European costs.

19 To access the Appendix, click on the Appendix link in the box to the right of the article online.

20 The number of cancer patients in each country for each year was obtained using data from national registries contributing to the EUROCare database, as well as peer-reviewed studies documenting the number of cancer cases by year in France, Germany, and the United States.


22 In a sensitivity analysis, we investigated the extent to which examining all twenty-three European countries available in the EUROCare-4 database for the period 1995–99 would change these results. We found that the difference in life expectancy between the United States and Europe was 1.2 years using this approach, compared with 1.8 years in the main analysis. These results do not bear on the main findings of the study, which examined differences in survival gains over time relative to each location’s own baseline.

23 Survival differences ranged between a 2.1-year survival advantage for the United States for prostate cancer to a 0.5-year survival advantage for the European countries. All differences were significant (p < 0.05) except for those for Hodgkin’s lymphoma and thyroid cancer.

24 In a sensitivity analysis, we calculated the net value of the survival benefits in the United States by comparing levels of survival for patients diagnosed in 1995–99 with costs per patient for this same period. Using this approach, the net value of survival benefits was $115,000 for the average US cancer patient, and the aggregate annual value to the US population with cancer was $175 billion.


26 This finding is consistent with that of previous US-specific research. See, for example, Lakdawalla DN, Sun EC, Jena AB, Reyes CM, Goldman DP, Philipson TJ. An economic evaluation of the war on cancer. J Health Econ. 2010;29(3):333–46.


30 Etzioni R, Feuer E. Studies of pros-

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In this month’s Health Affairs, Tomas Philipson and coauthors report on their study examining differences in survival for cancer patients between the United States and Europe, and whether or not higher spending on cancer treatment in the United States justified these differences. They found that US cancer patients experienced greater survival gains than their European counterparts, even after considering higher US costs.

The authors write that their study “suggests that the higher-cost US system of cancer care delivery may be worth it,” while acknowledging that more research is required to determine what specific tools or treatments are driving improved cancer survival in the United States.

“I was interested in the general and common argument that the US tends to spend more on health care without having better health outcomes,” says Philipson, the Daniel Levin Chair of Public Policy at the Irving B. Harris Graduate School of Public Policy Studies at the University of Chicago. “That seemed to fly in the face of rich foreigners who come to the US for specialty care.” He says that having completed this study, “I am leaning toward the belief that the policy community is misguided on their interpretation of international spending differences, and that both Europeans and US citizens may be spending their money wisely on oncology care.”

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