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Health Systems Performance and Cancer Outcomes

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Do the characteristics of health systems influence cancer outcomes? Although caveats are required when undertaking international comparisons of both health systems and cancer outcomes, observed differences cannot solely be explained by data problems or economic development. Health systems can influence cancer outcomes through three mechanisms: coverage, innovation, and quality of care. First, in countries where population coverage is incomplete, patients may find certain services excluded or face substantial copayments or deductibles. Second, there are variations in the rate at which innovative treatments are introduced, reflecting in particular the need for publicly funded health systems to compare costs and benefits of increasingly expensive treatments given demands for other treatments. Third, systematic differences in quality of care (early diagnosis, timely and equitable access to specialist care, and existence of systematic coordination between these activities) may lead to variations in cancer outcomes.

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This monograph looks at international variations in the care provided to people with cancer in different countries. A key issue in evaluating these variations is the extent to which health systems might impact on outcomes. This paper reviews, first, the basis on which such judgments can be made, in particular the international comparability of cancer registration, and, second, the characteristics of health systems that might impact on the effectiveness of the care that is provided.

Measuring Outcomes

At the outset, one must define what a health system is. There are many different definitions, varying in respect of the boundaries of the system, each with implications for assessing outcomes. Thus, the 2000 World Health Report included "all activities whose primary purpose is to promote, restore and maintain health" (1). However, in this chapter, we refer to a narrower health-care system defined as the "combined functioning of public health and personal healthcare services" that are under the "direct control of identifiable agents, especially ministries of health" (2).

The first step in assessing the contribution of health systems to cancer outcomes is to collect the necessary data. The most important in a series of international comparisons of cancer survival have been the four successive European Cancer Registry (EUROCARE) projects, covering 20 European countries (3) and the CONCORD program, covering 101 population-based cancer registries in 31 countries on five continents (4). EUROCARE-5 will cover 27 countries in Europe in 2012, and CONCORD-2, now in progress, will cover 50 countries worldwide.

At the national level, many hospital-based registries also exist: The outcome data they provide relate to a catchment area rather than to a defined population, but they often collect more detailed data on stage at diagnosis, which is a key prognostic factor as well as an indicator of the quality of primary care and the referral system. The most widely used example is the US National Cancer Data Base (NCDB), which covers about 1400 facilities and about 70% of cases of cancer in the United States.

However, there are still substantial gaps in coverage by cancer registries. For example, the 20-country EUROCARE-4 project has national (100%) coverage in 10 participating countries, but in some the coverage up to 2000 has been low (Germany 1%, Czech Republic 8%, Poland 9%) (5). Ill-founded concerns about data protection and consent in a few countries have sometimes impeded the creation or expansion of registries. In Germany and Hungary, cancer registries were shut down in the early 1990s. The previously successful national registry in Estonia was prevented from operating effectively from 1996 (6); imminent failure of cancer registration required emergency legislation in the United Kingdom in 2000 (7), and in the United States, the US Department of Veterans Affairs has more recently declined to supply data due to concerns about disclosure (8). This is despite evidence that the vast majority of the public are unconcerned by this use of personal data (9).

It is, however, important to be aware of a number of methodological and comparability issues when exploring any potential association between outcomes and health systems. The US Surveillance, Epidemiology and End Results (SEER) program systematically underrepresents African Americans and poorer people, leading to an overestimate of national survival levels (4,10). There are also considerable international variations in the performance of registries, measured, for example, by the percentage of cases that are reported only at death (11). Finally, especially for cancers that can be detected early by screening, it is necessary to take account of the possibility of lead-time bias, whereby the existence of a screening program leads to the detection of more cancers at an early stage in their natural history, but where subsequent treatment does not affect the point at which the patient

dies. This will artificially increase the recorded survival but at no benefit to the patient, and indeed may cause harm given the longer period of psychological distress (12).

A corollary is the incomplete availability of data on health systems. Despite heroic efforts to standardize data collection in recent years, in particular by the Organisation for Economic Co-operation and Development, there are still many problems in undertaking quantitative comparisons of health systems (13). The first problem, of relevance when comparing measures such as expenditure, is how to define the boundaries of the health system. Although there has been much progress in developing national health accounts, there are still difficulties in allocating costs at interfaces, such as those between health and social care and between clinical care and research. The second is the comparability of inputs. The skills, roles, and task profiles of many health workers vary among countries. So do the sources of data and the units in which these inputs are measured. For example, are numbers of health professionals based on headcounts or whole-time equivalents? Do they capture those employed in all sectors (such as prison health or the military)? In countries with predominantly statutory systems, do the data include the private sector?

Collectively, there are many definitional problems. Consequently, when reading the remainder of this paper, it is important to recognize that a degree of caution is required when interpreting the findings that are reported. Nonetheless, the available data show clear differences in survival from many cancers among countries (14). Some of this variation can be attributed to differences in resources available for health care. For example, a study of cancer survival in European countries found a close correlation between survival from all cancers combined and both gross national product and total expenditure on health (15). However, there is considerable evidence that the way in which the resources are actually used is also important (16).

How Might the Organization of Health Systems Impact on Cancer Outcomes?

Health systems can influence the outcome of any disease in a population through three mechanisms. First, and self-evidently, only those with effective coverage by or access to the health system can benefit from it. Hence, although there has been considerable progress worldwide in achieving universal coverage, there are many parts of the world where that is still no more than an aspiration. Even in advanced industrialized countries there may be gaps. The most notorious example is the United States, and although recent legislation seeks to address this in part (17), even when it is implemented, some 23 million people will be left without insurance (18). Those without health insurance do receive some care in the United States, even if limited; they have some access to emergency care. However, many of those who are considered to have coverage may find themselves excluded from a wide range of services, especially if they have preexisting conditions, or they may face substantial copayments or deductibles. Although this creates significant methodological challenges to researchers, the United States does provide one of the main sources of evidence on the effect of incomplete coverage or access to health care.

Second, there is innovation. There have been enormous strides in the management of many cancers since the early 20th century, with cure rates for some cancers exceeding 90%. The number of new treatments is expanding steadily, although this is bringing challenges as the cost of drug development is the same whether the drug concerned is a so-called "blockbuster," given for many years to large numbers of patients with common chronic disorders, or for several months to small numbers of patients with rare cancers. Inevitably, however, the unit cost of the latter is vastly higher, and where the benefit is marginal in terms of survival or quality of life, publicly funded health systems must take account of the opportunity cost. Hence, there is a judgment to be made about what is affordable, leading, entirely appropriately, to international differences in access to certain innovative drugs.

Third, health systems may vary in the quality of care, although, in practice, the variation within a health system is likely to swamp any systematic differences that might be expected. Nonetheless, there may be some systematic differences between health systems that can be linked to variation in cancer outcomes. The existence, or otherwise, of a comprehensive, integrated approach to cancer management falls within this category.

Coverage and Access to Health Care

There is now a wealth of research showing substantial differences in the United States in the stage at diagnosis and the processes of care delivered to patients with different forms of coverage (19). Typically, among those aged under 65, before the age when all patients become eligible for Medicare, comparisons are made between those covered by private insurance, those without insurance, and those enrolled in Medicaid, which provides basic coverage for the poor. However, a degree of caution is required in interpreting the data because about one-third of those with Medicaid cover have only become eligible as a result of being diagnosed with cancer (20). The following examples are illustrative of what is a consistent pattern.

A study of incident cases diagnosed in Florida in 1994, where stage at diagnosis and insurance status were known, found increased odds ratios (OR) for late presentation (stage III or IV) among persons who were uninsured compared with those with private insurance (21). The increased risks were 67% for colorectal cancer, 159% for melanoma, 43% for breast cancer, and 47% for prostate cancer. Delayed presentation was also found among those enrolled in Medicaid, with an 87% increase for breast cancer and as much as 369% increase for melanoma. All these differences were statistically significant.

A comparison of the management of almost 7000 patients with invasive breast cancer in one American state between 1996 and 2005 found that women who were uninsured, compared with privately insured women, presented with larger tumors, were much less likely to be node-negative, were less likely to be accessing breast-conserving surgery (where indicated), and very much less likely to be accessing reconstructive surgery (22). Among uninsured women, 15.5% underwent no surgical treatment at all, compared with only 4.3% of those with private insurance, consistent with the overall picture of later presentation. Another study used data on patients diagnosed between 1998 and 2004 recorded on the US

NCDB (23). Uninsured patients and those enrolled in Medicaid were significantly more likely than privately insured patients to present with advanced-stage cancer. The differences were greatest for cancers that can potentially be detected early. Patients lacking insurance were twice as likely to present with late-stage colorectal cancer (stage III or IV) as those with private insurance (odds ratio [OR] 2.0, 95% confidence interval [CI] 1.9–2.1), whereas those enrolled in Medicaid were 1.6-fold more likely to present late (95% CI 1.5–1.7). For advanced-stage melanoma, the odds ratios were 2.3 (2.1–2.5) for uninsured patients and 3.3 (3.0–3.6) for those enrolled in Medicaid compared with privately insured patients. Very similar findings were obtained in a study of over 500 000 women, diagnosed with breast cancer between 1998 and 2003, also on the NCDB (24). Similar findings were obtained in a survey of women diagnosed in 2004–2005 (25).

All the studies that have examined the impact of race found that black and Hispanic patients had an increased risk of advanced-stage disease at diagnosis, regardless of insurance status, compared with white patients.

A recent study sought explicitly to assess the future impact of health-care reform in the United States, again using the NCDB (26). It took those patients diagnosed with a range of cancers in the age group 55–74 years. It then compared those aged 55–64 years and who had private insurance with three other groups. The first comprised those in the same age group who were uninsured. The second comprised those in the age group 65–74 years with basic Medicare coverage: although it provides access to health care, it involves substantial deductibles and copayments, which may still restrict access to care. The fourth group comprised those enrolled in Medicare Advantage schemes, in which individuals pay extra for a range of additional benefits that, in general, do not involve deductibles or copayments but instead have a fixed rate fee for a consultation. In keeping with the previous research, this study found a significantly higher risk among the uninsured of first attendance with advanced cancers of the prostate, lung and bronchus, breast, colon and rectum, uterine corpus, bladder, and thyroid, and for melanoma. Those with basic Medicare also had an increased risk of presenting with late-stage disease, although to a much lesser extent, for melanoma and thyroid cancers. They were also more likely to present late with the same cancers as the uninsured, although again the increased risk was lower. However, there was no significant difference between those under 65 with private insurance and those over 65 with Medicare Advantage.

Collectively, this evidence is entirely consistent with other evidence showing that those Americans without insurance are less likely to seek care when they feel it necessary, or to undergo routine healthchecks (27) or cancer screening (28). However, it also raises the question of whether late presentation is the only reason for worse cancer survival among those without adequate coverage. This is difficult to determine, as much of the literature has focused on characteristics that often coincide with being uninsured, such as African American race and low income. However, the evidence from the survival analysis within Veterans Affairs health-care service shows that the ethnic disparities typically present between white and African Americans can be attenuated if the provider delivers high-quality health care and achieves equal access (29–30). Ayanian et al. found higher death rates from breast cancer at between 54 and 89 months after diagnosis for women who were uninsured or enrolled in Medicaid, compared with those with private insurance, after adjusting for stage at diagnosis and, as one would expect, the relative disadvantage was confined to those with local or regional disease rather than those with distant metastases at presentation (31). Robbins et al. also found significantly lower survival among those under 65 years with rectal cancer who lacked insurance. This persisted after adjustment for treatment (surgical procedure, margins at primary site, chemo- and radiotherapy, etc.) and stage. They estimated that differences in stage and treatment accounted for approximately 53% of the excess mortality, whereas other factors accounted for approximately 17% (32). Kwok et al. found that uninsured patients and those enrolled with Medicaid and who had head and neck cancer had a significantly greater probability of dying than those with private insurance, after adjustment for a wide range of variables, including stage at diagnosis (hazard ratio 1.50, 95% CI 1.07–2.11) (33). In a population-based study in Kentucky, McDavid et al. found lower 3-year survival in uninsured than privately insured patients with cancers of the colorectum, breast, lung, and prostate, after adjustment for age group, sex, race, and stage at diagnosis (34). The reasons for such differences in survival are not entirely clear, although Wu et al. found that women with breast cancer but without insurance coverage were less likely to receive chemotherapy according to accepted guidelines (35).

In those countries with universal coverage, socioeconomic factors may also have an impact on access to health services. Research from the United Kingdom indicates that women living in deprived areas are less likely to access cervical (36) and breast screening (37). Poorer socioeconomic groups had a longer delay in diagnosis for prostate cancer, whereas no differences by socioeconomic groups were identified for other types of cancer (colon, lung, ovary, breast, and non-Hodgkin lymphoma) (38). Differences in cancer survival between socioeconomic groups were partially attributed to stage at diagnosis and access to optimal treatment (39).

Therefore, in assessing the impact of health systems on overall cancer outcomes, an important consideration is whether they provide timely and effective care to the entire population.

Innovation

The political division of Europe during the Cold War provided an important natural experiment, because countries in the Soviet bloc were unable to access a number of innovative technologies. The impact of obtaining access to innovative treatment has been neatly illustrated by a comparison of mortality from testicular cancer in the two parts of Germany (40). Death rates in the west began to decline from the mid-1970s, whereas they remained high in the east until 1989 when reunification made modern treatments available. However, now, at least in high-income countries, differences are more subtle and they are also considerably more controversial. A series of reports from the Karolinska Institute, Stockholm (41–43), assessed patients' access to cancer medication in high-income countries through sales and uptake of oncology drugs. The reports highlighted large variations across countries in relation to level of uptake of new drugs, sales of select drugs, and time period over which cancer drugs became available. This highlighted how the impact of innovation reflects not only the investment in

development of new chemical entities but also the investment by payers in making them available to patients. In the latest report, from 2009 (43), the authors suggest that differences in the level and speed of uptake of cancer drugs lead to inequalities in access to medication among the EU countries. The 2007 report (42) purported to show that access to new drugs was linked to improved survival and larger reductions in cancer mortality rates. Findings such as these have led some authors to advocate accelerating the approval process of new drugs and increased funding to purchase them (44).

The Swedish research was, however, funded by the pharmaceutical industry, which has an obvious strong vested interest in speeding up access to its products, even if the benefit they provide may be limited and the cost may be high. This work has also faced severe criticism for overestimating relative survival and failing to demonstrate robust temporal associations between the introduction of new drugs and cancer outcomes (45).

A literature review by Morgan et al. (46) found that chemotherapy made a relatively small contribution to cancer survival overall. Using data from trials that reported a significant benefit due solely to chemotherapy, they calculated the absolute number of patients who would benefit from chemotherapy for each of 22 cancers, the proportion of those who would achieve a benefit, and the percentage increase in 5-year survival that would be expected due solely to cytotoxic chemotherapy. Although the overall 5-year survival from these cancers was about 60%, the contribution of chemotherapy was estimated to be about 2.3% in Australia and 2.1% in the United States.

Given the importance of considering cost-effectiveness of innovative treatment, a key question about health systems is their ability to incorporate such considerations within their decision-making processes. It is intuitive, but also supported by evidence, that this is easier in countries with single payers or mechanisms by which payers can work together, as in European national health services (47). In their comparison of UK and US health systems, which noted the challenges of comparability, Faden et al. (48) contend that the British National Health Service is fairer in providing access to end-of-life treatment to patients, as it has mechanisms of dealing with the availability of expensive cancer drugs not routinely covered by the state, in contrast with Medicaid beneficiaries, for whom the treatment is subject to copayment (40).

Quality

Early detection of cancer is crucial for increasing the chances of successful treatment and subsequent survival. Implementation of population-based cancer screening programs varies widely internationally. In the European Union, there are screening programs in 22 of the 27 EU countries for breast cancer, whereas 15 have cervical screening programs and 12 screen for colorectal cancer (49). However, these programs vary in eligibility criteria, recall systems, and uptake rates. Thus, in practice, coverage of cervical cancer screening in the EU ranges between 10% and 79% of eligible women (50). Countries also vary in the extent to which their systems are organized or opportunistic, with consequences for the quality of the intervention. Thus, a Finnish woman can expect to undergo seven smears in her lifetime, whereas a German woman may have 50 or more, yet cervical cancer mortality in Finland is half that in Germany (42).

Another aspect of quality is the speed of access to specialized care. A recent analysis of survival trends (51) shows a persisting survival deficit for cancers of the bowel, lung, breast, and ovary in the United Kingdom and Denmark, compared with Sweden, Norway, Canada, and Australia. Artifacts due to loss to follow-up, representativeness of the registries, and data quality were ruled out as potential causes of such variation in survival during the period 1995–2007 (51). The authors suggest that the most likely reason is late diagnosis and delay in obtaining definitive treatment (51–53) as well as some variations in diagnostic and surgical practice (54–55). A subsequent study that looked at the completeness of stage data and implications for comparability in stage-specific cancer survival in these countries for the same cancer types showed that, after standardizing staging across registries, survival estimates were consistent with previous findings, despite the presence of stage migration in some regions (56).

Other work has suggested that the low 1-year cancer survival in the United Kingdom and Denmark could reflect the gate-keeping role of general practitioners (57). A shortage of trained personnel and equipment to undertake screening has also been invoked as an explanation for the performance of Denmark, whereas a report by the King's Fund, in the United Kingdom (58), makes the case for improved early diagnosis and access to specialist care.

One way of quantifying the impact of early treatment on survival is by measuring avoidable deaths from cancer, defined as "the component of excess cancer mortality that would not occur if the relative survival were at the higher level seen in a comparator population, instead of what was actually observed"(59). A comparison of cancer survival in the United Kingdom in relation to the mean for European countries participating in the EUROCARE study (59) found that, in the 15 years between 1985 and 1999, avoidable premature mortality in Britain constituted about 6–7% of total cancer-related mortality, with the highest share of that avoidable mortality attributable to cancers of the breast (18%), prostate (14%), colon (9%), stomach (8%), and lung (2%). The authors also noted that, even with universal coverage, about half of the avoidable premature mortality in the United Kingdom can be attributed to socioeconomic inequalities. The importance of inequalities receives more support from a population-based study on avoidable deaths from cancer in England (60), which suggests that, for cancers included in UK national screening programs (cervical, breast), improving the uptake of screening among deprived population would dramatically reduce the number of premature deaths. A study of avoidable cancer deaths in Finland also showed how inequalities in cancer survival could exist even in one of the most equitable societies in Europe, where health-care standards are high, thus emphasizing the importance of early diagnosis for everyone (61). Not unexpectedly, a series of studies by Gorey et al. (62–64) shows how the Canadian health-care system achieves much more equitable access to services than does the United States, largely attributed to universal coverage by health insurance in Canada.

Survivorship, as another measure of quality of care for cancer patients, has been used increasingly in the United States since 2006. Care after cancer, including screening for recurrences and late effects of cancer therapies, is not standardized there, and transition

to posttreatment care may be more complex in the absence of comprehensive survivorship care plans (65).

The cure fraction, defined as the proportion of survivors (technically, the relative survival) when the death rate in the cancer patients is no longer significantly higher than the death rate in the general population, is potentially a very useful measure of the overall effectiveness of cancer care. It can only be derived from population-based cancer survival analysis. However, robust international comparisons with this indicator are not yet widely available.

The management of cancer requires coordination of a wide range of health system inputs, ensuring ready access to relevant expertise when needed. Intuitively, this may be easier where services are concentrated in a few large centres, potentially bringing additional benefits from greater experience by the health professionals involved. There is an extensive literature on the association between volume and outcome, although there are many methodological problems involved (66). However, a recent systematic review concludes that better outcomes are achieved at higher treatment volumes, especially for complex cancer surgery and specifically for pancreatectomy, esphagectomy, gastrectomy, and rectal resection (67).

A related question is whether the creation of a systematic cancer plan to bring these elements together makes a difference. One study took advantage of a natural experiment following the introduction of such a plan in England in 2000. Neighboring Wales had reorganized its services in the 1990s. The evaluation concluded that improvements in 1-year survival in England, which had lagged behind those in Wales before full implementation of the cancer plan in 2004, then overtook it, although there was no difference in 3-year survival trends (68). The authors concluded that the English cancer plan had probably had some beneficial effect, but a definitive judgment could not be reached.

In Denmark, national cancer pathways have been introduced in 2008 as a response to the intense debate in the media and among the medical professionals on "internal waiting times" and their impact on the relatively poor survival in Denmark compared with other countries (69), but the impact on cancer outcomes is not yet visible.

Conclusions

Health systems do impact on cancer outcomes, although our scope to discover why is handicapped by constraints on both our ability to define and describe health systems and our ability to achieve robust international comparisons of cancer survival. Health systems have an impact on cancer outcomes through three broad mechanisms: first, by ensuring population coverage and access to care; second, by ensuring access to innovative treatment; third, by ensuring that the care that is accessed is of high quality. Although all three are necessary, the first is most important. However, there is clearly considerable further scope to increase our knowledge on these important relationships if we are to provide more meaningful input into policy debates about how best to improve cancer control.

References

1. World Health Organization. *The World Health Report 2000—Health Systems: Improving Performance*. Geneva, Switzerland: World Health Organization; 2000.
2. Arah OA, Westert GP, Hurst J, Klazinga NS. A conceptual framework for the OECD Health Care Quality Indicators Project. *Int J Qual Health Care*. 2006;18 (suppl 1):5–13.
3. Sant M, Allemani C, Santaquilani M, Knijn A, Marchesi F, Capocaccia R; EUROCARE Working Group. EUROCARE-4. Survival of cancer patients diagnosed in 1995-1999. Results and commentary. *Eur J Cancer*. 2009;45(6):931–991.
4. Coleman MP, Quaresma M, Berrino F, et al.; CONCORD Working Group. Cancer survival in five continents: a worldwide population-based study (CONCORD). *Lancet Oncol*. 2008;9(8):730–756.
5. De Angelis R, Francisci S, Baili P, et al.; EUROCARE Working Group. The EUROCARE-4 database on cancer survival in Europe: data standardisation, quality control and methods of statistical analysis. *Eur J Cancer*. 2009;45(6):909–930.
6. Rahu M, McKee M. Epidemiological research labelled as a violation of privacy: the case of Estonia. *Int J Epidemiol*. 2008;37(3):678–682.
7. Coleman MP, Evans BG, Barrett G. Confidentiality and the public interest in medical research–will we ever get it right? *Clin Med*. 2003;3(3):219–228.
8. Furlow B. Accuracy of US cancer surveillance under threat. *Lancet Oncol*. 2007;8(9):762–763.
9. Barrett G, Cassell JA, Peacock JL, Coleman MP; National Cancer Registry. National survey of British public's views on use of identifiable medical data by the National Cancer Registry. *BMJ*. 2006;332(7549):1068–1072.
10. Merrill RM, Dearden KA. How representative are the surveillance, epidemiology, and end results (SEER) program cancer data of the United States? *Cancer Causes Control*. 2004;15(10):1027–1034.
11. Robinson D, Sankila R, Hakulinen T, Møller H. Interpreting international comparisons of cancer survival: the effects of incomplete registration and the presence of death certificate only cases on survival estimates. *Eur J Cancer*. 2007;43(5):909–913.
12. Parkin DM, Moss SM. Lung cancer screening: improved survival but no reduction in deaths–the role of "overdiagnosis". *Cancer*. 2000;89(11 suppl):2369–2376.
13. McKee M, Nolte E, Figueras J. Strategies for health services. In: Detels R, Beaglehole R, Lansang MA, Gulliford M, eds. *Oxford Textbook of Public Health*. 5th ed. Oxford, UK: Oxford University Press; 2009:1668–1681.
14. Verdecchia A, Francisci S, Brenner H, et al.; EUROCARE-4 Working Group. Recent cancer survival in Europe: a 2000-02 period analysis of EUROCARE-4 data. *Lancet Oncol*. 2007;8(9):784–796.
15. Verdecchia A, Baili P, Quaglia A, et al. Patient survival for all cancers combined as indicator of cancer control in Europe. *Eur J Public Health*. 2008;18(5):527–532.
16. Micheli A, Coebergh JW, Mugno E, et al. European health systems and cancer care. *Ann Oncol*. 2003;14 (suppl 5):v41–v60.
17. Obama B. Modern health care for all Americans. *N Engl J Med*. 2008;359(15):1537–1541.
18. Siskin A. *Treatment of Noncitizens Under the Patient Protection and Affordable Care Act*. Washington, DC: Congressional Research Service; 2011. CRS Report R41714.
19. Ward E, Halpern M, Schrag N, et al. Association of insurance with cancer care utilization and outcomes. *CA Cancer J Clin*. 2008;58(1):9–31.
20. Bradley CJ, Gardiner J, Given CW, Roberts C. Cancer, Medicaid enrollment, and survival disparities. *Cancer*. 2005;103(8):1712–1718.
21. Roetzheim RG, Pal N, Tennant C, et al. Effects of health insurance and race on early detection of cancer. *J Natl Cancer Inst*. 1999;91(16):1409–1415.
22. Coburn N, Fulton J, Pearlman DN, Law C, DiPaolo B, Cady B. Treatment variation by insurance status for breast cancer patients. *Breast J*. 2008;14(2):128–134.
23. Halpern MT, Ward EM, Pavluck AL, Schrag NM, Bian J, Chen AY. Association of insurance status and ethnicity with cancer stage at diagnosis for 12 cancer sites: a retrospective analysis. *Lancet Oncol*. 2008;9(3):222–231.
24. Halpern MT, Bian J, Ward EM, Schrag NM, Chen AY. Insurance status and stage of cancer at diagnosis among women with breast cancer. *Cancer*. 2007;110(2):403–411.
25. DeSantis C, Jemal A, Ward E. Disparities in breast cancer prognostic factors by race, insurance status, and education. *Cancer Causes Control*. 2010;21(9):1445–1450.

26. Ward EM, Fedewa SA, Cokkinides V, Virgo K. The association of insurance and stage at diagnosis among patients aged 55 to 74 years in the national cancer database. *Cancer J*. 2010;16(6):614–621.
27. Ayanian JZ, Weissman JS, Schneider EC, Ginsburg JA, Zaslavsky AM. Unmet health needs of uninsured adults in the United States. *JAMA*. 2000;284(16):2061–2069.
28. Hsia J, Kemper E, Kiefe C, et al. The importance of health insurance as a determinant of cancer screening: evidence from the Women's Health Initiative. *Prev Med*. 2000;31(3):261–270.
29. Rabeneck L, Souchek J, El-Serag HB. Survival of colorectal cancer patients hospitalized in the Veterans Affairs Health Care System. *Am J Gastroenterol*. 2003;98(5):1186–1192.
30. Coleman MP. Letter from America. *Lancet*. 2012;379(9823):1288.
31. Ayanian JZ, Kohler BA, Abe T, Epstein AM. The relation between health insurance coverage and clinical outcomes among women with breast cancer. *N Engl J Med*. 1993;329(5):326–331.
32. Robbins AS, Chen AY, Stewart AK, Staley CA, Virgo KS, Ward EM. Insurance status and survival disparities among nonelderly rectal cancer patients in the National Cancer Data Base. *Cancer*. 2010;116(17):4178–4186.
33. Kwok J, Langevin SM, Argiris A, Grandis JR, Gooding WE, Taioli E. The impact of health insurance status on the survival of patients with head and neck cancer. *Cancer*. 2010;116(2):476–485.
34. McDavid K, Tucker TC, Sloggett A, Coleman MP. Cancer survival in Kentucky and health insurance coverage. *Arch Intern Med*. 2003;163(18):2135–2144.
35. Wu XC, Lund MJ, Kimmick GG, et al. Influence of race, insurance, socioeconomic status, and hospital type on receipt of guideline-concordant adjuvant systemic therapy for locoregional breast cancers. *J Clin Oncol*. 2012;30(2):142–150.
36. Baker D, Middleton E. Cervical screening and health inequality in England in the 1990s. *J Epidemiol Community Health*. 2003;57(6):417–423.
37. Maheswaran R, Pearson T, Jordan H, Black D. Socioeconomic deprivation, travel distance, location of service, and uptake of breast cancer screening in North Derbyshire, UK. *J Epidemiol Community Health*. 2006;60(3):208–212.
38. Neal RD, Allgar VL. Sociodemographic factors and delays in the diagnosis of six cancers: analysis of data from the "National Survey of NHS Patients: Cancer". *Br J Cancer*. 2005;92(11):1971–1975.
39. Woods LM, Rachet B, Coleman MP. Origins of socio-economic inequalities in cancer survival: a review. *Ann Oncol*. 2006;17(1):5–19.
40. Becker N, Boyle P. Decline in mortality from testicular cancer in West Germany after reunification. *Lancet*. 1997;350(9079):744.
41. Wilking N, Jonsson B. *A Pan-European Comparison Regarding Patient Access to Cancer Drugs*. Stokholm, Sweden: Karolinska Instituet; 2005.
42. Jonsson B, Wilking N. A global comparison regarding patient access to cancer drugs. *Ann Oncol*. 2007;18 (suppl 3):iii1–iii77.
43. Wilking N, Jonsson B. *Comparator Report on Patient Access to Cancer Drugs in Europe*. Stokholm, Sweden: Karolinska Instituet; 2009.
44. Drummond MF, Mason AR. European perspective on the costs and cost-effectiveness of cancer therapies. *J Clin Oncol*. 2007;25(2):191–195.
45. Coleman MP. Not credible: a subversion of science by the pharmaceutical industry. Commentary on a global comparison regarding patient access to cancer drugs. *Ann Oncol*. 2007; 18(suppl 3):1–75; discussion 585–587.
46. Morgan G, Ward R, Barton M. The contribution of cytotoxic chemotherapy to 5-year survival in adult malignancies. *Clin Oncol (R Coll Radiol)*. 2004;16(8):549–560.
47. Sullivan R, Peppercorn J, Sikora K, et al. Delivering affordable cancer care in high-income countries. *Lancet Oncol*. 2011;12(10):933–980.
48. Faden RR, Chalkidou K, Appleby J, Waters HR, Leider JP. Expensive cancer drugs: a comparison between the United States and the United Kingdom. *Milbank Q*. 2009;87(4):789–819.
49. Commission of the European Communities. *Report from the Commision to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Implementation of the Council Recommendation of 2 December 2003 on Cancer Screening*. Brussels, Belgium: COM; 2008.
50. Anttila A, von Karsa L, Aasmaa A, et al. Cervical cancer screening policies and coverage in Europe. *Eur J Cancer*. 2009;45(15):2649–2658.
51. Coleman MP, Forman D, Bryant H, et al.; ICBP Module 1 Working Group. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet*. 2011;377(9760):127–138.
52. Sant M, Allemani C, Capocaccia R, et al.; EUROCARE Working Group. Stage at diagnosis is a key explanation of differences in breast cancer survival across Europe. *Int J Cancer*. 2003;106(3):416–422.
53. Sant M; Eurocare Working Group. Differences in stage and therapy for breast cancer across Europe. *Int J Cancer*. 2001;93(6):894–901.
54. Gatta G, Zigon G, Aareleid T, et al. Patterns of care for European colorectal cancer patients diagnosed 1996-1998: a EUROCARE high resolution study. *Acta Oncol*. 2010;49(6):776–783.
55. Allemani C, Storm H, Voogd AC, et al. Variation in 'standard care' for breast cancer across Europe: a EUROCARE-3 high resolution study. *Eur J Cancer*. 2010;46(9):1528–1536.
56. Walters S, Maringe C, Butler J, Brierley JD, Rachet B, Coleman MP. Comparability of stage data in cancer registries in six countries: lessons from the International Cancer Benchmarking Partnership. *Int J Cancer*. 2013;132(3):676–685.
57. Vedsted P, Olesen F. Are the serious problems in cancer survival partly rooted in gatekeeper principles? An ecologic study. *Br J Gen Pract*. 2011;61(589):e508–e512.
58. Foot C, Harrison T. *How to Improve Cancer Survival: Explaining England's Relatively Poor Rates*. London, UK: The King's Fund; 2011.
59. Abdel-Rahman M, Stockton D, Rachet B, Hakulinen T, Coleman MP. What if cancer survival in Britain were the same as in Europe: how many deaths are avoidable? *Br J Cancer*. 2009;101(suppl 2):115–124.
60. Ellis L, Coleman MP, Rachet B. How many deaths would be avoidable if socioeconomic inequalities in cancer survival in England were eliminated? A national population-based study, 1996-2006. *Eur J Cancer*. 2012;48(2):270–278.
61. Pokhrel A, Martikainen P, Pukkala E, Rautalahti M, Seppä K, Hakulinen T. Education, survival and avoidable deaths in cancer patients in Finland. *Br J Cancer*. 2010;103(7):1109–1114.
62. Gorey KM, Holowaty EJ, Fehringer G, et al. An international comparison of cancer survival: Toronto, Ontario, and Detroit, Michigan, metropolitan areas. *Am J Public Health*. 1997;87(7):1156–1163.
63. Gorey KM, Luginaah IN, Holowaty EJ, Fung KY, Hamm C. Breast cancer survival in Ontario and California, 1998-2006: socioeconomic inequity remains much greater in the United States. *Ann Epidemiol*. 2009;19(2):121–124.
64. Gorey KM, Kliewer E, Holowaty EJ, Laukkanen E, Ng EY. An international comparison of breast cancer survival: Winnipeg, Manitoba and Des Moines, Iowa, metropolitan areas. *Ann Epidemiol*. 2003;13(1):32–41.
65. Kirsch B. Many US cancer survivors still lost in transition. *Lancet*. 2012;379(9829):1865–1866.
66. Halm EA, Lee C, Chassin MR. Is volume related to outcome in health care? A systematic review and methodologic critique of the literature. *Ann Intern Med*. 2002;137(6):511–520.
67. Killeen SD, O'Sullivan MJ, Coffey JC, Kirwan WO, Redmond HP. Provider volume and outcomes for oncological procedures. *Br J Surg*. 2005;92(4):389–402.
68. Rachet B, Maringe C, Nur U, et al. Population-based cancer survival trends in England and Wales up to 2007: an assessment of the NHS cancer plan for England. *Lancet Oncol*. 2009;10(4):351–369.
69. Vrangbaek K, Nielsen MB. Colorectal cancer care in Denmark: status and dilemmas. *Eur J Health Econ*. 2010;10(suppl 1):S5–13.

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