The cancer wars 3

Cancer survival: global surveillance will stimulate health policy and improve equity

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Millions of people will continue to be diagnosed with cancer every year for the foreseeable future. These patients all need access to optimum health care. Population-based cancer survival is a key measure of the overall effectiveness of health systems in management of cancer. Survival varies very widely around the world. Global surveillance of cancer survival is needed, because unless these avoidable inequalities are measured, and reported on regularly, nothing will be done explicitly to reduce them.

Introduction

In September, 2011, the UN General Assembly in New York held its first high-level meeting on non-communicable diseases (NCDs). The governments of 113 countries set new strategic objectives for worldwide control of these diseases. The declaration[1] emphasised the need for wider research and better policy for the prevention and control of all NCDs, including cancer, because of their rapidly growing effect on public health, especially in developing countries.

In 2008, about 12·7 million people were diagnosed with cancer around the world, and 7·6 million people died from it. More than half (56%) of those who were diagnosed in 2008 and almost 64% of those who died from cancer were living in low-income and middle-income countries.[2] In 2010, about 8 million people died from cancer, a 38% increase since 1990.[3] Even conservative projections suggest that more than 20 million people will be diagnosed with cancer every year by 2030, with more than 13 million cancer deaths.[4] The increase in the number of patients with cancer will arise mainly from population growth and ageing of the population, but in many countries the risk of developing cancer at a given age (age-specific risk) will also rise. All three factors will affect poor countries more than rich ones. Without global policy initiatives, the disparity between the growing cancer burden and the capacity of poorer countries to deal with it can be expected to widen.

After the World Health Assembly in 2012, the governments of 119 countries unanimously agreed a set of 25 indicators and a voluntary global target to reduce premature deaths in people aged 30–69 years from all NCDs by 25% by 2025.[5] This target would represent a reduction of about 1·5 million from the predicted 6 million premature cancer deaths each year by 2025. Achievement of this target will need more effective prevention, to reduce incidence, and more effective health systems, to improve survival.

Only population-based cancer registries can indicate whether these two requirements are being met. In 2010, however, WHO assessed the capacity for prevention and control of NCD in 185 countries. Less than half (48%) even had national reporting of mortality. Population-based cancer registries were active in just 17% of low-income countries and 79% of high-income countries, but barely a third (36%) had published a report in the previous 3 years.[6] Only 21% of the world's population was covered by cancer registration in 2006.[7] At a global level, therefore, reliable and up-to-date information on cancer incidence, mortality, and survival remains scarce.

In this Series paper I cover the need for investment in cancer control, the role of health systems, and the public health usefulness of trends and inequalities in cancer survival. I also cover estimation of the proportion of patients with cancer in a given population who can be deemed to have been cured, and avoidable premature deaths arising from inequalities in survival, before addressing the need for continuous global surveillance of cancer survival as one of the metrics for improvement of cancer control.

Investing in cancer control

Prevention will always be preferable to cure, especially for diseases with such high morbidity and lethality. When the causes are known, however, the latency between exposure and disease for many cancers is measured in decades, and for about half of all cancers the causes are still unknown. For primary prevention, long-term investment is needed to reduce age-specific cancer risks for future populations, but research is underfunded. The US National Cancer Institute is the largest cancer research agency in the world, with an annual budget of more than US$5 billion, but the proportion allocated to prevention fell from 11% to 7% in the decade up to 2010.[8]

Outcomes research does little better. As the Chief Medical Officer to the American Cancer Society, Otis Brawley, puts it:[9] "Politicians almost always support basic research, but rarely support studies on the effectiveness of treatment." He is broadly right; in the European Union and the USA, less than 10% of cancer research spending was on outcomes research in 2002–03.[10] Systematic reviews of the comparative effectiveness of different treatments in the USA date only from 2007.

Cancer causes a huge burden of disability and morbidity for patients and their families. It caused an estimated 4·5 million (95% uncertainty interval 3·3–5·9 million) years of life lived with disability in 2010, compared with 2·5 (1·9–3·3) million years of disability in 1990.[11] That is an increase of 76·5% in just two decades.

The global economic cost of cancer is also huge. Losses of productivity and the cost of care from disability and premature death caused by cancer were estimated at US$895 billion for 2008,[12] more than the cost of AIDS, tuberculosis, and malaria combined. Even when the costs of cancer treatment (almost $300 billion) are excluded, this estimate is equivalent to 1·5% of the estimated gross domestic product of all countries combined. A later estimate suggested that the annual cost of cancer (without the costs to families and carers) in 2010 was higher, at $1·16 trillion, or more than 2% of global gross domestic product, and that investment in cancer care and control with prevention and more effective treatment could have saved up to $200 billion of this total.[13]

The World Oncology Forum in Lugano, Switzerland, concluded in October, 2012, that present strategies to control cancer are not working. Preventable cancers are not being prevented; patients are suffering and dying unnecessarily from cancers that are detectable and treatable; and the model for developing effective new curative therapies is not fit for purpose.[14] The Forum called for aggressive tobacco control measures, strengthening of health systems, and the removal of barriers to morphine use for pain relief.

Health systems, cancer survival, and equity

The millions of cancer patients who will be diagnosed every year for the foreseeable future need access to optimum treatment, wherever they live, to improve their chances of survival. The Universal Declaration of Human Rights (Article 25) states: "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability...in circumstances beyond his control." Health systems that can provide adequate care are the responsibility of governments everywhere.

This issue is one of both politics and public health; the costs of cancer treatment, driven by over-use and the progressively shorter lifecycles of expensive medicines and imaging technologies, are rising so rapidly that even rich countries face economic difficulty in delivering high-quality cancer care equally to all their citizens.

The scarcity of evidence to inform political debate has been identified as a major problem: "Political toleration of unfairness in access to affordable cancer treatment is unacceptable".[15] One review concluded[16] that decision makers need timely, high-quality evidence, at both local and global levels, "to inform efficient allocation of resources among competing priorities, to enhance accountability and to introduce policy change".

Panel 1: World Cancer Declaration 2008[17] (Union for International Cancer Control, Geneva): selected goals for 2020
• Achieve major improvements in cancer survival in all countries (goal 11)
• Improve measurement of global cancer burden and impact of cancer control interventions (goal 2)
• Ensure effective delivery systems (goal 1)
• Dispel damaging myths and misconceptions (goal 5)

The survival of all patients diagnosed with cancer in a given population is one of the most important measures of the overall effectiveness of the health-care system in the treatment and management of cancer. Worldwide improvement in survival is one of the goals of the World Cancer Declaration[17] (panel 1).

Variation in survival

There is huge global inequity in access to cancer treatment. For example, radiotherapy can cure some cancers and is a crucial component of therapy for up to half of all cancers; however, although 56% of cancer patients live in low-income and middle-income countries, these countries have only 30% of the world's radiotherapy facilities. 30 countries in Africa and Asia do not have a single radiotherapy machine.[18] Within Europe, variation in cancer treatment is wide,[19] and variation in survival is also associated with national wealth (gross domestic product), total national expenditure on health, and the amount of investment in health technology such as CT scanners.[20]

The disparities in survival for children with cancer have a similarly stark association with access to treatment. About 80% of childhood cancers arise in low-income countries. Low survival is associated with failure to start treatment, or abandonment of treatment, in up to 60% of cases.[21]

Much of the global variation in survival for adults is likely to be attributable to differences in access to diagnostic and treatment services, and to inadequate investment in health resources.[22]

International differences in survival can be viewed through the same lens as the differences in survival within a given country, between rich and poor citizens,[23] or majority and minority ethnic groups, or insured and under-insured patients. Few except the extremely rich can afford the cost of cancer treatment without help. Private health insurance is also expensive. Without insurance, access to treatment in private health-care systems is limited; in the USA, the costs of treatment can add bankruptcy and the loss of a home to the shock of a cancer diagnosis. Not surprisingly, therefore, health insurance affects the stage at diagnosis, the investigation, the treatment, and survival.[24] A hospital-based study of 374 000 cancer patients diagnosed in the USA during 1998–2004 showed that uninsured patients and those

from ethnic minorities were twice as likely to present with advanced disease as were insured or ethnic majority patients;[25] the researchers concluded: "Although many factors other than insurance status also affect the quality of care received, adequate insurance is a crucial factor for receiving appropriate cancer screening and timely access to medical care."

Having survived an extraordinary constitutional challenge in the US Supreme Court, the Affordable Health Care Act will at least extend some form of health insurance to 30 million people in the world's richest country who at present have none, including people with cancer if they have been uninsured for 6 months.[26]

Survival also varies widely between countries of low income and middle income.[27] The Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries took its cue from wide inequalities in cancer survival in 2009.[28] It called on poor countries to increase access to health services, reduce treatment costs, and strengthen health systems to cope with their growing cancer burden. The Task Force proposed strategies such as national health insurance, improvements in primary care, and use of off-patent drugs. Options are available; WHO's Cancer Programme revised the list of essential cancer drugs more than 10 years ago, showing that curable cancers and those cancers for which the cost-benefit ratio favours drug treatment could be managed with regimens based on only 17 drugs, all of which were off patent and available as generic formulations at low cost.[29]

Useful or futile?

Is it useful to identify differences in cancer survival between countries, between regions within a country, or between populations defined by racial or ethnic group or socioeconomic status? Does it have any effect on health policy or the public, especially if the countries being compared have widely different economic development, some of them extremely poor, others with civil conflicts?

Population-based survival is an estimate of the probability of survival after the background mortality that the patients would have experienced if they had not had cancer has been taken into account; the background mortality is derived from life tables of all-cause mortality in the general population.[30] This approach is crucial for international comparisons and survival trends, because background mortality rates differ widely by age, sex, and race or ethnicity, as well as between countries and over time. Overall survival estimates are age-standardised with the International Cancer Survival Standard weights.[31]

The usefulness of evidence on trends and differences in cancer survival has been challenged, more often by asseveration than by evidence, either because critics cannot accept that population-based survival reflects a wider view of the overall effectiveness of health systems than merely the competence of doctors,[32] or because the survival comparisons are judged incompatible with trends

in mortality,[33] or because of unsubstantiated claims about data quality.[34,35] Yet a body of corroborative evidence—not from cancer registries—shows differences in willingness to contact health services, compliance with screening or diagnostic services, late diagnosis, access to investigations and treatment, abandonment of treatment, the availability of specialist health-care staff, equipment, and medicines, and expenditure on health care.

Differences in population-based cancer survival between countries and regions or between population groups defined by socioeconomic status, race or ethnicity, or health insurance are increasingly being used to drive improvement in health services, from the poorest to the richest countries in the world.

In Algeria, the very low survival for cancers of the breast, colon, rectum, and prostate, identified in the first worldwide study of cancer survival (CONCORD[22]), has been attributed to deficiencies in health care, including delays in access to radiotherapy, and inadequate information systems. A ministerial decree will soon require cervical cancer screening for early diagnosis, to improve survival, and a national network of cancer centres and registries will be established to improve treatment and the monitoring of incidence and survival.[36]

Even without population-based cancer registration, acute lymphocytic leukaemia (ALL) in children in Mexico seems unusually common.[37] Wide differences in survival for children with ALL and Hodgkin's disease among nine major paediatric oncology units led to a review of diagnostic delay, investigations, treatment, and costs. Recommendations were made to standardise terminology, to issue guidelines for investigation and treatment, and to reduce the proportion of children who do not complete treatment.[38] In 2004, Mexico began a highly ambitious plan (Seguro Popular) to extend state-funded health insurance to cover treatment for childhood ALL, later extending it to other childhood malignancies, and then to all malignancies in individuals younger than 18 years.[39] Coverage of the Fund for Protection against Catastrophic Expenditures, which provides financial support for high-cost illnesses, rose from 5% to 55% of children with cancer between 2006 and 2009, and a review concluded[39] that it was "imperative to continue to evaluate the effectiveness of this policy to increase access [to treatment] and identify opportunities to reduce the regional disparities in survival". The proportion of children with cancer who did not complete treatment dropped from 27% in 2000 to 4% since 2007.[40] The Mexican Health Minister, Dr Salomón Chertorivski-Woldenberg announced in 2012 that 3 year survival from childhood ALL has also risen sharply, from about 30% to 70%.

Cancer survival in Ragusa, Sicily, southern Italy, was very low by European standards in the 1990s,[41] and much lower than in the wealthier regions of central and northern Italy, particularly for breast and cervical cancer. This low survival was attributed to late diagnosis, the absence of sufficient oncologists, and under-provision of

radiotherapy. Widespread criticism in regional and national newspapers led to the inclusion of new oncology services, including radiotherapy, in the regional strategy for 2000–02. The Italian national health plan for 2001–03 also responded to wide differences in population-based survival, and to studies showing wide regional inequality in access to optimum treatment, with unequal distribution of radiotherapy structures, especially in southern and parts of central Italy. The strategy recommended at least three cancer registries in southern Italy, with a focus on recording of data on stage at diagnosis and treatment, to help assess the effectiveness of interventions, the extent of compliance with treatment guidelines, and the cost-effectiveness of investment in health services.[42]

Studies by the International Cancer Benchmarking Partnership have shown that differences between six wealthy countries in population-based survival up to 2007 from cancers of the colon and rectum, breast, lung, and ovary[43] are only partly attributable to differences in stage at diagnosis; survival for each stage of disease also varies widely, which suggests variations in the adequacy of diagnosis and treatment.[44]

These studies have led to several policy developments. In the UK, England has set "levels of ambition" on survival to be achieved under the National Health Services Outcomes Framework.[45] Poor survival from colorectal cancer prompted public awareness campaigns designed to achieve earlier diagnosis by encouraging people to seek medical help if they have blood in their faeces for longer than 3 weeks. In a letter to primary care physicians explaining the likely effect of this campaign on their workload, the National Cancer Director for England, Sir Mike Richards, acknowledged the importance of survival: "Survival for the more common cancers has improved significantly in recent years, but England's survival still lags behind the European average. [For example] It is estimated that 1700 deaths could be avoided each year if our [5 year] bowel cancer survival was as good as the best in Europe. Later diagnosis is seen as a key reason for the poorer survival." The estimates of avoidable premature deaths were derived for 20 different cancers[46] from the EUROCARE studies of survival in many European countries.[47]

The International Cancer Benchmarking Partnership studies also showed that the information held by cancer registries on investigations, stage at diagnosis, and treatment is commonly incomplete or unreliable, even in wealthy countries.[48] This finding has prompted strategies to improve the completeness and quality of data on stage in population-based registries in the UK and in Victoria, Australia.

In Canada, the population survey of cancer awareness used in the study by the the International Cancer Benchmarking Partnership[49] was extended to obtain a national picture of public perceptions of the importance of cancer symptoms, and to inform policy aimed at achieving earlier diagnosis. Variation in lung cancer survival among Canadian provinces has also led to policy initiatives to reduce the time from diagnosis to surgery and radiotherapy.

A study of 20 000 women diagnosed with breast cancer in the late 1990s showed it was more likely to be diagnosed at the early, node-negative stage in the USA than in 12 European countries.[50] Net survival was lower in eastern Europe than other parts of Europe, especially for older women with locally advanced or metastatic tumours, which suggests that low health-care expenditure constrained the quality of treatment.

Cancer control plans

The availability of systematic information on international differences and trends in cancer survival will challenge the myth, prevalent in many countries,[17] that cancer is uniformly fatal. When members of the public see that people can survive cancer, this damaging misconception can be corrected, and more patients will be prompted to seek and complete treatment. This aim is one of the goals of the World Cancer Declaration (panel 1).

Equally, international comparisons can challenge the misconception that cancer outcomes in a given country are satisfactory; when governments see reliable data showing that cancer survival is lower than in other comparable countries, political action will follow, as in Algeria after the first CONCORD study, or in Denmark, Italy, and the UK after the EUROCARE studies. In his preface to the first national cancer plan in England, the Health Secretary Alan Milburn wrote: "Despite the best efforts of the NHS staff and cancer patients across the country, decades of under-investment alongside outdated practices mean that survival rates for many of the major cancers lag behind the rest of Europe. The poor are still far more likely to get cancer than the rich, and their chances of survival are lower too."[51]

Inequalities in cancer survival shown by the EUROCARE studies[52] are one of the reasons for the reappearance of cancer control on the political agenda of the European Union.[53,54]

Within the past two decades, international disparities in survival have underpinned regional or national cancer plans in Denmark (2005), Northern Ireland (1996), England (2000, 2007, 2011), Wales (2006), Victoria, Australia (2008), and Sweden (2009); all are explicitly focused on improving survival.

Health systems can affect cancer outcomes through coverage, innovation, and quality of care. Where population coverage is incomplete, some services might be unavailable or too expensive. Publicly funded health systems might have to use cost-benefit evaluation to prioritise expensive new technologies or treatments against other demands. Cancer outcomes can also be affected by how well the health system provides early diagnosis, prompt and equitable access to optimum care, and coordination of the care pathway.[55]

Improvement of the overall standard of health care seems likely to improve cancer survival trends for the entire population. Thus, survival from cancers of the breast, colon, and prostate was 16–20% lower in East than in West Germany in the 1970s and 1980s, but these differences had largely vanished within 20 years of German reunification in 1990, after rapid integration of political and health-care systems. For patients diagnosed during 2002–06, the differences between east and west in 5 year age-standardised relative survival were less than 3% for most of the common cancers, despite tougher economic conditions in eastern parts of Germany.[56] In Estonia, the rapid increase in survival from cancers of the prostate, kidney, and bladder after independence was re-established in 1991 was attributed to wider access to imaging and better pathology, enabling diagnosis of smaller lesions.[57] In several other eastern European countries, cancer survival increased more rapidly than in western and northern European countries between 1991 and 2002.[58]

Cancer survival is increasingly used to formulate cancer control strategies and to prioritise cancer control measures.[59] Cancer survival trends are also being used to evaluate the effectiveness of national cancer plans after they have been implemented, by assessing their contribution to improvement of overall survival,[60,61] or to reduction of socioeconomic inequalities in survival,[62] or to the cost-effectiveness of strategies.[63] In view of the nature of cancer survival, substantial time will elapse before such estimates can provide a useful overall assessment of the effectiveness of the plan. After a lag time of at least 2–3 years, to allow for effective implementation of the plan, what is needed is observation of the survival of patients who are diagnosed over several more years, then the time to obtain and analyse the follow-up data. Even for 1 year survival, it can be 8–10 years from promulgation of a plan before its effect on national levels of cancer survival can be reliably assessed.[60]

Inequalities in survival and avoidable premature deaths

Equal treatment for a given cancer should yield equal outcome, irrespective of race,[64] geography, or socioeconomic status.[65] Racial, ethnic, and socioeconomic differences in survival reflect differences in access to the best health services for minority populations, whether for black people in the USA,[66] Aboriginal and Torres Strait Islander people in Australia,[67] or Māori in New Zealand.[68]

The wider effect on public health of cancer survival disparities can contribute to the formulation of health strategy.[69] The persistent difference in survival between the UK and other countries in Europe, identified in the EUROCARE studies, has enabled estimation of the number of avoidable premature cancer deaths, which now underpins the initiative for earlier diagnosis in England.[70] The core target of the present national cancer strategy is a reduction of 50% in the number of avoidable premature deaths by 2015, compared with the highest cancer survival in other European countries.[71] Survival trends within a single country have also been used to estimate how many premature deaths have been avoided by increases in survival over time.[72]

International, regional, and socioeconomic disparities in survival represent large numbers of avoidable premature deaths.[46,73] Even in the Nordic countries, where survival is high, some 5300 (2·5%) of the deaths from 12 common cancers during 2008–12 would have been avoidable if regional variations in survival had been eliminated.[74] In Europe more widely, disparities in 5 year survival between the Nordic countries and other European countries could have led to up to 150 000 avoidable premature deaths a year during 1995–99, or 12% of the 1·3 million cancer deaths per year that happened within 5 years of diagnosis in Europe at the end of the 20th century.[75]

The aphorism "Death in old age is inevitable, but death before old age is not" has been attributed to Sir Richard Doll. It can be seen as encapsulating both the need for primary prevention and the idea that we should focus on extending survival after cancer into old age, not simply to continue counting the numbers of cancer deaths. The number of avoidable premature deaths among cancer patients can be derived from either relative or net survival, because the survival estimates already take account of differences in mortality from other causes by age and sex. The number of avoidable premature deaths from a given cancer obviously depends on the population size and the incidence of the cancer, over and above any differences in survival with the

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Panel 2: Goals of CONCORD programme* for global surveillance of cancer survival

- To provide directly comparable estimates of cancer survival in many countries worldwide, for ten common adult malignant disorders and childhood leukaemia, by use of individual data from population-based cancer registries, supplied to agreed standards and analysed centrally

- To document worldwide trends in cancer survival since 1995 as the basis for systematic global surveillance of cancer survival, and to enable examination of the underlying causes of survival differences

- To derive measures such as the population cure fraction, cancer prevalence, and the number of avoidable premature deaths, as a basis for informing national and global policy for cancer control

*Organisations supporting the CONCORD programme: Asociación Española contra el Cáncer (Madrid, Spain), Association of European Cancer Leagues (Brussels, Belgium), Canadian Association of Provincial Cancer Agencies (Toronto, ON, Canada), Canadian Council of Cancer Registries (Toronto, ON, Canada), Canadian Partnership Against Cancer (Toronto, ON, Canada), Cancer Focus Northern Ireland (Belfast, UK), Cancer Institute New South Wales (Sydney, NSW, Australia), Cancer Research UK (London, UK), Centers for Disease Control and Prevention (Atlanta, GA, USA), Children with Cancer UK (London, UK), Danish Cancer Society (Copenhagen, Denmark), European CanCer Organisation (Brussels, Belgium), European Institute for Women's Health (Dublin, Ireland), International Agency for Research on Cancer (Lyon, France), International Atomic Energy Agency (Vienna, Austria), International Network for Cancer Treatment and Research (Brussels, Belgium), Israel Centre for Disease Control (Tel-Hashomer, Israel), Jolanta Kwaśniewska's Foundation (Warsaw, Poland), Members of the European Parliament Against Cancer (Brussels, Belgium), National Cancer Institute, Center for Global Health (Washington DC, USA), National Institute for Health Research Consumer Liaison Group (Leeds, UK), National Institute for Cancer Epidemiology and Registration (Zürich, Switzerland), North American Association of Central Cancer Registries (Chicago, IL, USA), Organisation for Economic Co-operation and Development (Paris, France), Swiss Cancer League (Zürich, Switzerland), Swiss Foundation for Cancer research (Bern, Switzerland), Swiss Re (London, UK), Union for International Cancer Control (Geneva, Switzerland), WHO Regional Office for Europe (Copenhagen, Denmark), World Bank (Washington, DC, USA).

reference population. This way of identifying unacceptably high risks of death in the first few years after a cancer diagnosis is adequate for examination of trends in avoidable mortality within a given population. It is also easily understood by politicians.[76]

By contrast, international differences in avoidable premature mortality should be expressed as the proportion of all cancer deaths that would be avoidable if relative survival were as high as in the comparator population. This approach takes account of population size and cancer incidence, and it should change only if the survival differentials change.[46]

Avoidable deaths could become a useful metric for investigation of whether differences in cancer survival are being reduced or not, whether between countries, or between population groups defined by socioeconomic status, race, or ethnicity within a country.[77,78]

## The proportion of patients who are cured

Identification of individual cancer patients who might be judged clinically cured is difficult. In the public-health context, however, the proportion of all cancer patients in the population who can be regarded as cured can be estimated from the point where a curve of relative (or net) survival reaches a plateau. This point indicates that, as a group, the patients who have survived up to that time after cancer diagnosis no longer have significant excess mortality over that of the general population.[79] When it is estimated from relative survival, the cure fraction does not depend on the levels of background mortality, and it is not affected by lead-time bias. Estimates of cure have been made for patients with cancers of the bowel, breast, and cervix in Europe.[80] The same approach can also be used to estimate the time since diagnosis at which the point of cure is reached and the median survival of patients who die before that point.

Global surveillance of cancer survival

At the World Cancer Congress in Geneva in 2008, the Union for International Cancer Control (UICC) called for 11 ambitious goals to be achieved by 2020, and updated the World Cancer Declaration[17] to include: "there will be major improvements in cancer survival...in all countries". The UICC is committed to providing progress reports every 2 years. Global surveillance of cancer survival will support several of the goals in the UICC World Cancer Declaration (panel 1).

Reliable information on global trends and disparities in survival can be expected to help focus debate on reducing geographical and racial or ethnic inequalities.[81] Long-term surveillance of world-wide trends in cancer incidence has provided information for causal research, and the basis of prevention and screening since the 1960s.[82] Continuous global surveillance of cancer survival is likely to become equally valuable—a reliable information source for cancer patients and researchers, a stimulus for change in health policy and health-care
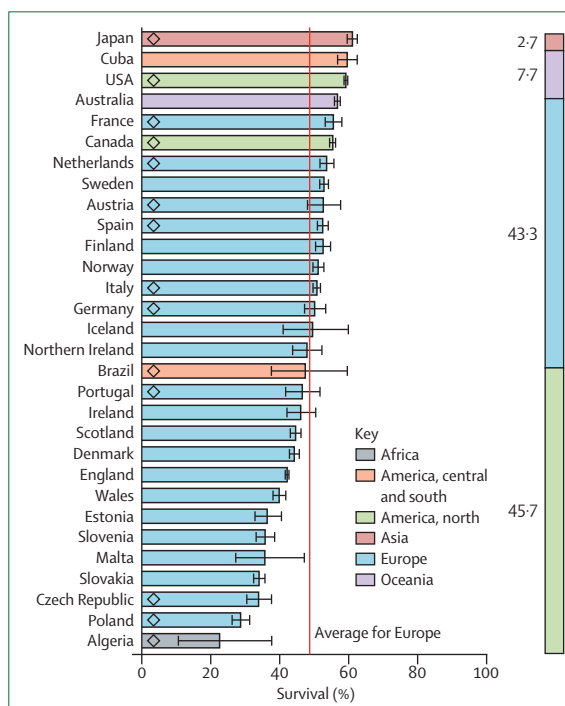
Figure 1: **Age-standardised 5 year relative survival, women aged 15–99 years diagnosed with breast cancer during 1990–94 and followed up to 1999, 31 countries**
Diamond symbols indicate data covering less than 100% of the country. Vertical red line=average for 22 European countries in the EUROCARE-3 study,[83] age-standardised to the International Cancer Survival Standard weights.[31] Right-hand vertical bar indicates percentage contribution of each continent to the total number of cases analysed (contributions under 1% not labelled). In Cuba, problems with data quality might have led to overestimation.
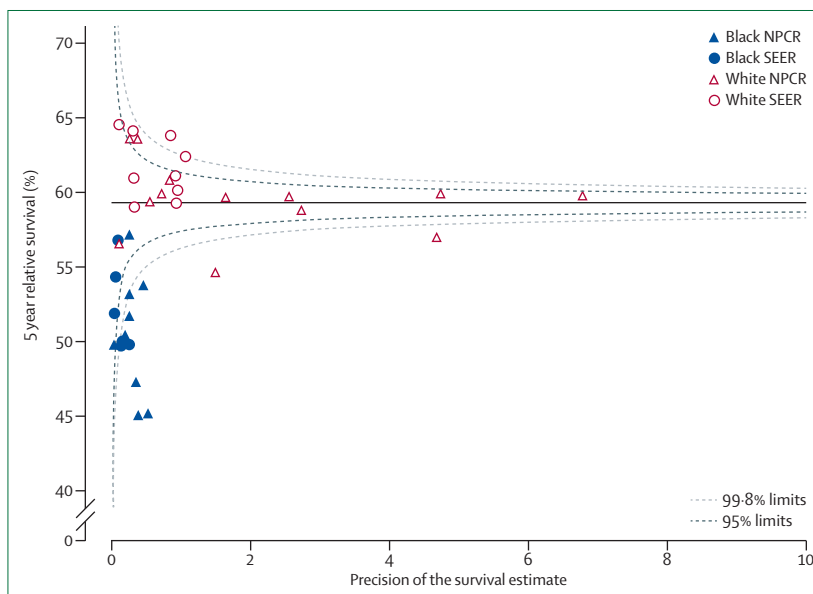
Figure 2: **Funnel plot of 5 year relative survival**
Estimated with life tables specific for state and race, and age-standardised to the International Cancer Survival Standard weights,[31] men aged 15–99 years diagnosed with colorectal cancer during 1990–94 and followed up to 1999: black and white, 16 US States and six Metropolitan Areas, by race and cancer registration system; National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology and End Results (SEER) programme. Funnel plots are one of many new methods to visualise and interpret survival patterns.[84,85]

systems, and a key metric for the global surveillance of cancer control. The importance of global surveillance of cancer survival is recognised by many national and international agencies, including patients' lobby groups, politicians, and research agencies (panel 2).

The first worldwide comparison of cancer survival between high-income and low-income countries (CONCORD[22]) showed that global disparities in cancer survival were as wide as the disparities in health-care provision. For example, 5 year relative survival for breast cancer (women), colorectal, and prostate cancers was generally high in North America, Australia, and Japan, and in northern, western, and southern Europe; it was low in eastern Europe, Algeria, and Brazil (figure 1). It also confirmed that the racial disparities in survival cancer identified in the 10% of the US population that had been covered by the SEER programme until the 1990s also occurred right across the USA (figure 2). The

same quality control criteria and analytical methods were used for all datasets. Individual tumour records for 1·9 million adults (aged 15–99 years) diagnosed during 1990–94 and followed up to 1999 were supplied by 101 population-based cancer registries in 31 countries on five continents. 16 of the 31 countries provided data with national coverage.

CONCORD-2 is designed to bring those estimates up to date. It will initiate continuous global surveillance of cancer survival. More than 280 cancer registries have registered to participate, and 261 have submitted data so far. Of the 69 countries involved, 29 are classified by the World Bank as being low income or middle income: nine in Africa, eight of the nine participating countries in Central and South America, nine of the 16 in Asia, and three of the 29 in Europe. The study will provide cancer survival information for most of the wealthier countries, including 30 of the 34 Member States of the Organisation

	All countries		More-developed countries		Less-developed countries	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Stomach						
Male	640 600 (9·7%)	464 400 (11·0%)	173 700 (5·8%)	110 900 (7·3%)	466 900 (12·8%)	353 500 (13·1%)
Female	349 000 (5·8%)	273 600 (8·2%)	102 000 (3·9%)	70 800 (5·8%)	247 000 (7·2%)	202 900 (9·6%)
All	989 600 (7·8%)	738 000 (9·7%)	275 700 (5·0%)	181 700 (6·6%)	713 900 (10·0%)	556 400 (11·5%)
Colorectum						
Male	663 600 (10·0%)	320 600 (7·6%)	389 700 (13·1%)	166 200 (10·9%)	274 000 (7·5%)	154 400 (5·7%)
Female	570 100 (9·4%)	288 100 (8·6%)	337 700 (13·1%)	153 900 (12·6%)	232 400 (6·7%)	134 100 (6·3%)
All	1 233 700 (9·7%)	608 700 (8·0%)	727 400 (13·1%)	320 100 (11·6%)	506 400 (7·1%)	288 500 (6·0%)
Liver						
Male	522 400 (7·9%)	478 300 (11·3%)	81 700 (2·7%)	75 400 (4·9%)	440 700 (12·1%)	402 900 (14·9%)
Female	225 900 (3·7%)	217 600 (6·5%)	40 300 (1·6%)	39 900 (3·3%)	186 000 (5·4%)	177 700 (8·4%)
All	748 300 (5·9%)	695 900 (9·2%)	122 000 (2·2%)	115 300 (4·2%)	626 700 (8·8%)	580 600 (12·0%)
Lung						
Male	1 095 200 (16·5%)	951 000 (22·5%)	482 600 (16·2%)	412 000 (27·0%)	612 500 (16·8%)	539 000 (20·0%)
Female	513 600 (8·5%)	427 400 (12·8%)	241 700 (9·4%)	188 400 (15·4%)	272 000 (7·9%)	239 000 (11·3%)
All	1 608 800 (12·7%)	1 378 400 (18·2%)	724 300 (13·0%)	600 400 (21·8%)	884 500 (12·4%)	778 000 (16·1%)
Breast	1 383 500 (22·9%)	458 400 (13·7%)	692 200 (26·8%)	189 500 (15·5%)	691 300 (20·0%)	268 900 (12·7%)
Cervix	529 800 (8·8%)	275 100 (8·2%)	76 500 (3·0%)	32 900 (2·7%)	453 300 (13·1%)	242 000 (11·4%)
Ovary	225 500 (3·7%)	140 200 (4·2%)	100 300 (3·9%)	64 500 (5·3%)	125 200 (3·6%)	75 700 (3·6%)
Prostate	903 500 (13·6%)	258 400 (6·1%)	648 400 (21·8%)	136 500 (8·9%)	255 000 (7·0%)	121 900 (4·5%)
Leukaemia						
Male	195 900 (3·0%)	143 700 (3·4%)	79 000 (2·7%)	48 600 (3·2%)	116 500 (3·2%)	95 100 (3·5%)
Female	155 000 (2·6%)	113 800 (3·4%)	61 700 (2·4%)	38 700 (3·2%)	93 400 (2·7%)	75 100 (3·5%)
All	350 900 (2·8%)	257 500 (3·4%)	140 700 (2·5%)	87 300 (3·2%)	209 900 (3·0%)	170 200 (3·5%)
Cancers included in CONCORD-2 study						
Male	4 021 200 (60·7%)	2 616 400 (61·9%)	1 855 100 (62·4%)	949 600 (62·1%)	2 165 600 (59·3%)	1 666 800 (61·8%)
Female	3 952 400 (65·5%)	2 194 200 (65·6%)	1 652 400 (63·9%)	778 600 (63·7%)	2 300 600 (66·6%)	1 415 400 (66·7%)
All	7 973 600 (62·9%)	4 810 600 (63·5%)	3 507 500 (63·1%)	1 728 200 (62·8%)	4 466 200 (62·8%)	3 082 200 (63·9%)
All cancers except skin						
Male	6 629 100 (100%)	4 225 700 (100%)	2 975 200 (100%)	1 528 200 (100%)	3 654 000 (100%)	2 697 500 (100%)
Female	6 038 400 (100%)	3 345 800 (100%)	2 584 800 (100%)	1 223 200 (100%)	3 453 600 (100%)	2 122 600 (100%)
All	12 667 500 (100%)	7 571 500 (100%)	5 560 000 (100%)	2 751 400 (100%)	7 107 600 (100%)	4 820 100 (100%)

Table: **New diagnoses and deaths from cancer in 2008: number and proportion by sex of patients and economic development**[2,82]

for Economic Co-operation and Development. About half the participating countries will contribute data with 100% coverage of the national population.

The study will quantify international differences and trends in survival for patients diagnosed with cancer of the stomach, colon, rectum, liver, lung, breast (women), ovary, cervix, or prostate in adults (15–99 years), and leukaemia in both adults and children (0–14 years). These 10 types of cancer represent 63% of all new cancer cases and deaths, in both more and less developed[86] regions of the world (table). The proportions for each cancer differ widely between rich and poor countries: prostate cancer accounts for about 22% of cases among men in high-income countries, but only 7% in low-income and middle-income countries. By contrast, liver cancer comprises about 9% of cancers in low-income and middle-income countries, but only 2% in high-income countries.

Population-based cancer survival provides a key measure of progress in cancer control, because it reflects the overall effectiveness of health systems. For the broadest view of cancer control, trends in incidence and mortality should be examined alongside those for survival.[87] Comparisons of incidence, survival, and mortality have been published for many cancers in Europe[88] and for Europe, Australia, and Canada,[43] but not worldwide. Incidence, survival, and mortality trends in participating countries will be compared, to improve the interpretation of survival comparisons.

Global surveillance of survival will initially include patients diagnosed during 1995–2009. Data for patients diagnosed since 2009 will be accepted as the programme develops. By 2014, information on worldwide cancer survival trends should start to become available on a regular basis.

Estimation of the number of avoidable premature cancer deaths and the population cure fraction in a wide range of populations will contribute to the second goal of the World Cancer Declaration—to improve measurement of the cancer burden and of the effect of cancer control interventions (panel 1). For childhood leukaemia, worldwide comparisons of the proportions of cure and avoidable mortality should provide a valuable insight into the extent of early diagnosis, access to treatment, and failure to complete treatment. Estimation of the cure fraction for cancers of the bowel and cervix and for childhood leukaemia[89] might be possible, but probably not for breast, lung, or liver cancers.

On taking office in January, 2007, WHO Director-General Margaret Chan spoke of the importance of assessment of the effect of global policy on people's health, using the aphorism: "what gets measured, gets done".[90] She has used this saying frequently since then, but measurement alone is not enough—action must follow. Global inequalities in cancer survival are wide; unless they are accurately measured, and regularly reported, there will be no pressure for national or global policies designed to reduce them. Several million patients will die prematurely each year from cancers that could have been diagnosed earlier and treated more effectively.

Global surveillance of cancer survival will contribute to a more comprehensive overview of the effectiveness of national health systems in managing the world's growing cancer burden. Surveillance will highlight international differences, national trends, and racial and ethnic inequalities in cancer survival. The information should stimulate patients, politicians, and the public to demand improvements in cancer survival and to reduce inequality.

References
1 United Nations. Political declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. A/66/L.1. http://www.who.int/nmh/events/un_ncd_summit2011/en/ (accessed Nov 14, 2013).
2 Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. *CA Cancer J Clin* 2011; **61:** 69–90.
3 Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2013; **380:** 2095–128.
4 Bray F, Jemal A, Grey N, Ferlay J, Forman D. Global cancer transitions according to the Human Development Index (2008–2030): a population-based study. *Lancet Oncol* 2012; **13:** 790–801.
5 World Health Organization. Report of the Formal Meeting of Member States to conclude the work on the comprehensive global monitoring framework, including indicators, and a set of voluntary global targets for the prevention and control of noncommunicable diseases. Geneva: WHO, Nov 21, 2012. http://who.int/gb/NCDs/pdf/A_NCD_2-en.pdf (accessed Nov 14, 2013).
6 World Health Organization. Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2010 global survey. Geneva: WHO, 2013. www.who.int/chp/knowledge/national_prevention_ncds/en/ (accessed Nov 14, 2013).
7 Parkin DM. The evolution of the population-based cancer registry. *Nat Rev Cancer* 2006; **6:** 603–12.
8 O'Callaghan T. Introduction: the prevention agenda. *Nature* 2011; **471:** S2–S4.
9 Brawley OW, Goldberg P. How we do harm: a doctor breaks ranks about being sick in America. New York: St Martin's Press, 2012.
10 Eckhouse S, Sullivan R. A survey of public funding of cancer research in the European Union. *PLoS Med* 2006; **3:** e267. http://plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed/0030267 (accessed Dec 10, 2013).
11 Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2013; **380:** 2163–96.
12 Feachem RG, Sekhri NK, White KL. Getting more for their dollar: a comparison of the NHS with California's Kaiser Permanente. *BMJ* 2002; **324:** 135–41.
13 Knaul FM, Arreola-Ornelas H, Atun R, et al. Investing in cancer care and control. In: Knaul FM, Gralow J, Atun R, Bhadelia A, eds. Closing the cancer divide: an equity imperative. Boston: Harvard University Press, 2011: 71–91.
14 Cavalli F. An appeal to world leaders: stop cancer now. *Lancet* 2013; **381:** 425–26.
15 Sullivan R, Peppercorn J, Sikora K, et al. Delivering affordable cancer care in high-income countries. *Lancet Oncol* 2011; **12:** 933–80.

16 Keating N, Kouri E, Gralow JR, et al. Evidence for decision-making: strethening health information systems and the research base. In: Knaul FM, Gralow J, Atun R, Bhadelia A, eds. Closing the cancer divide: an equity imperative. Boston: Harvard University Press, 2011: 289–310.

17 Union for International Cancer Control. World Cancer Declaration. *UICC* 2010. http://www.uicc.org/declaration/world-cancer-declaration (accessed Nov 14, 2013).

18 International Atomic Energy Agency. Inequity in cancer care: a global perspective. IAEA Human Health Reports No. 3. Vienna: IAEA, 2011.

19 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:** 1528–36.

20 Micheli A, Coebergh JWW, Mugno E, et al. European health systems and cancer care. *Ann Oncol* 2003; **14** (suppl 5)**:** 41–60.

21 Mostert S, Arora RS, Arreola M, et al. Abandonment of treatment for childhood cancer: position statement of a SIOP PODC Working Group. *Lancet Oncol* 2011; **12:** 719–20.

22 Coleman MP, Quaresma M, Berrino F, et al, and the CONCORD Working Group. Cancer survival in five continents: a worldwide population-based study (CONCORD). *Lancet Oncol* 2008; **9:** 730–56.

23 Woods LM, Rachet B, Coleman MP. Origins of socio-economic inequalities in cancer survival: a review. *Ann Oncol* 2006; **17:** 5–19.

24 Roetzheim RG, Pal N, Gonzalez EC, Ferrante JM, Van Durme DJ, Krischer JP. Effects of health insurance and race on colorectal cancer treatments and outcomes. *Am J Public Health* 2000; **90:** 1746–54.

25 Halpern MT, Ward EM, Pavluck AL, et al. Association of insurance status and ethnicity with cancer stage at diagnosis for 12 cancer sites: a retrospective analysis. *Lancet Oncol* 2008; **9:** 222–31.

26 Editorial. Obama: health-care reform, part two. *Lancet Oncol* 2012; **13:** 1171.

27 Sankaranarayanan R, Swaminathan R, Brenner H, et al. Cancer survival in Africa, Asia, and Central America: a population-based study. *Lancet Oncol* 2010; **11:** 165–73.

28 Farmer P, Frenk J, Knaul FM, et al. Expansion of cancer care and control in countries of low and middle income: a call to action. *Lancet* 2010; **376:** 1186–93.

29 Sikora K, Advani S, Koroltchouk V, et al. Essential drugs for cancer therapy: a World Health Organization consultation. *Ann Oncol* 1999; **10:** 385–90.

30 Baili P, Micheli A, De Angelis R, et al, and the CONCORD Working Group. Life tables for world-wide comparison of relative survival for cancer (CONCORD study). *Tumori* 2008; **94:** 658–68.

31 Corazziari I, Quinn MJ, Capocaccia R. Standard cancer patient population for age standardising survival ratios. *Eur J Cancer* 2004; **40:** 2307–16.

32 Cookson JB. Cancer survival. *Lancet* 2000; **356:** 1611.

33 Autier P, Boniol M, Héry C, Masuyer E, Ferlay J. Cancer survival statistics should be viewed with caution. *Lancet Oncol* 2007; **8:** 1050–52, author reply 1053–54.

34 Beral V, Peto R. UK cancer survival statistics. *BMJ* 2010; **341:** c4112. http://www.bmj.com/content/341/bmj.c4112.short (accessed Dec 10, 2013).

35 Woods LM, Coleman MP, Lawrence G, Rashbass J, Berrino F, Rachet B. Evidence against the proposition that "UK cancer survival statistics are misleading": simulation study with National Cancer Registry data. *BMJ* 2011; **342:** d3399.

36 Beniaiche K. La déficience de notre système de santé est à l'origine du taux de survie si bas [in French]. *El Watan [Algeria].* Nov 30, 2012, http://www.elwatan.dz/actualite/la-deficience-de-notre-systeme-de-sante-est-a-l-origine-du-taux-de-survie-si-bas-30-11-2012-194147_109.php (accessed Jan 5, 2013).

37 Perez-Saldivar ML, Fajardo-Gutierrez A, Bernaldez-Rios R, et al. Childhood acute leukemias are frequent in Mexico City: descriptive epidemiology. *BMC Cancer* 2011; **11:** 355

38 Muñoz Hernández O, Cortés Gallo G, Garduño Espinosa J, et al. Informe final: análisis de los factores asociados a la variabilidad de los resultados en salud y costs del proceso de atención de cáncer en niños (leucemia linfoblástica aguda y linfoma de Hodgkin). Mexico City: Hospital Infantil de México Federico Gómez y Salud Seguro Popular, 2011.

39 Perez-Cuevas R, Doubova SV, Zapata Tarrés M, et al. Scaling up cancer care for children without medical insurance in developing countries: the case of Mexico. *Pediatr Blood Cancer* 2013; **60:** 196–203.

40 Rivera-Luna R, Correa-Gonzalez C, Tamirano-Alvarez E, et al. Incidence of childhood cancer among Mexican children registered under a public medical insurance program. *Int J Cancer* 2013; **132:** 1646–50.

41 Berrino F, Capocaccia R, Estève J, et al, eds. Survival of cancer patients in Europe: the EUROCARE-2 study (IARC Scientific Publications No. 151). Lyon: International Agency for Research on Cancer, 1999.

42 Ministry of Health. *Piano Sanitario Nazionale 2001–2003* [in Italian]. Rome, Ministry of Health, 2001.

43 Coleman MP, Forman D, Bryant H, et al, and the 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:** 127–38.

44 Maringe C, Walters S, Rachet B, et al, and the ICBP Module 1 Working Group. Stage at diagnosis and colorectal cancer survival in six high-income countries: a population-based study of patients diagnosed during 2000–2007. *Acta Oncol* 2013; **52:** 919–32.

45 Department of Health. NHS Outcomes Framework 2012-13. London: Department of Health, 2011.

46 Abdel-Rahman MA, Stockton DL, 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)**:** S115–24.

47 Berrino F, De Angelis R, Sant M, et al, and the EUROCARE Working Group. Survival for eight major cancers and all cancers combined for European adults diagnosed in 1995-99: results of the EUROCARE-4 study. *Lancet Oncol* 2007; **8:** 773–83.

48 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:** 676–85.

49 Forbes LJ, Simon AE, Warburton F, et al. Differences in cancer awareness and beliefs between Australia, Canada, Denmark, Norway, Sweden and the UK (the International Cancer Benchmarking Partnership): do they contribute to differences in cancer survival? *Br J Cancer* 2013; **108:** 292–300.

50 Allemani C, Sant M, Weir HK, et al. Breast cancer survival in the US and Europe: a CONCORD high-resolution study. *Int J Cancer* 2013; **132:** 1170–81.

51 Department of Health. The NHS Cancer Plan: a plan for investment, a plan for reform. London: Department of Health, 2000.

52 Sant M, Allemani C, Santaquilani M, Knijn A, Marchesi F, Capocaccia R, and the EUROCARE Working Group. EUROCARE-4. Survival of cancer patients diagnosed in 1995–1999: results and commentary. *Eur J Cancer* 2009; **45** (suppl 6)**:** 931–91.

53 Coleman MP, Alexe DM, Albreht T, et al, eds. Responding to the challenge of cancer in Europe. Ljubljana: Institute of Public Health of the Republic of Slovenia, 2008.

54 Commission of the European Communities. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Action against Cancer: European Partnership. http://ec.europa.eu/health/ph_information/dissemination/diseases/docs/com_2009_291.en.pdf (accessed Nov 14, 2013).

55 Karanikolos M, Ellis L, Coleman MP, McKee M. Health systems performance and cancer outcomes. *J Natl Cancer Inst Monogr* 2013; **46:** 7–12.

56 Jansen L, Gondos A, Eberle A et al. Cancer survival in Eastern and Western Germany after the fall of the iron curtain. *Eur J Epidemiol* 2012; **27:** 689–93.

57 Aareleid T, Brenner H. Trends in cancer patient survival in Estonia before and after the transition from a Soviet republic to an open-market economy. *Int J Cancer* 2002; **102:** 45–50.

58 Verdecchia A, Francisci S, Brenner H, et al, and the EUROCARE-4 Working Group. Recent cancer survival in Europe: a 2000–02 period analysis of EUROCARE-4 data. *Lancet Oncol* 2007; **8:** 784–96.

59 Department of Health. Improving outcomes: a strategy for cancer. London: Department of Health, 2011.

60 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:** 351–69.

61 Storm HH, Gislum M, Engholm G. [Cancer survival before and after initiating the Danish Cancer Control plan] [In Danish, English abstract]. *Ugeskr Læger [Danish Medical Journal]* 2008; **170:** 3065–69.

62 Rachet B, Ellis L, Maringe C, et al. Socioeconomic inequalities in cancer survival in England after the NHS cancer plan. *Br J Cancer* 2010; **103:** 446–53.

63 Philipson T, Eber M, Lakdawalla DN, et al. An analysis of whether higher health care spending in the United States versus Europe is 'worth it' in the case of cancer. *Health Aff (Millwood)* 2012; **31:** 667–75.

64 Brawley OW, Freeman HP. Race and outcomes: is this the end of the beginning for minority health research? *J Natl Cancer Inst* 1999; **91:** 1908–09.

65 Rachet B, Woods LM, Mitry E, et al. Cancer survival in England and Wales at the end of the 20th century. *Br J Cancer* 2008; **99** (suppl 1)**:** S2–10.

66 Brawley OW. Disaggregating the effects of race and poverty on breast cancer outcomes. *J Natl Cancer Inst* 2002; **94:** 471–73.

67 Morrell S, You H, Baker D. Estimates of cancer incidence, mortality and survival in aboriginal people from NSW, Australia. *BMC Cancer* 2012; **12:** 168.

68 Jeffreys M, Stevanovic V, Tobias M, et al. Ethnic inequalities in cancer survival in New Zealand: linkage study. *Am J Public Health* 2005; **95:** 834–37.

69 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:** e508–12.

70 Richards MA. The size of the prize for earlier diagnosis of cancer in England. *Br J Cancer* 2009; **101** (suppl 2)**:** S125–29.

71 Department of Health. Improving outcomes: a strategy for cancer— second annual report 2012. London: Department of Health, 2012.

72 Richards MA, Stockton DL, Babb P, Coleman MP. How many deaths have been avoided through improvements in cancer survival? *BMJ* 2000; **320:** 895–98.

73 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:** 1109–14.

74 Dickman PW, Gibberd RW, Hakulinen T. Estimating potential savings in cancer deaths by eliminating regional and social class variation in cancer survival in the Nordic countries. *J Epidemiol Community Health* 1997; **51:** 289–98.

75 Berrino F, Capocaccia R. Survival of European cancer patients. In: Coleman MP, Alexe DM, Albreht T, McKee CM, eds. Responding to the challenge of cancer in Europe. Ljubljana: Institute of Public Health of the Republic of Slovenia, 2008: 151–76.

76 Kelly R. Cancer deaths. Commons Hansard [Parliamentary Record], London: HMSO, 2002: c703W-c704W, http://www.publications. parliament.uk/pa/cm200102/cmhansrd/vo020311/text/20311w16. htm#20311w16.html_sbhd0 (accessed Dec 10, 2013).

77 Seppä K, Hakulinen T, Läärä E. Avoidable deaths and random variation in patients' survival. *Br J Cancer* 2012; **106:** 1846–49.

78 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:** 270–78.

79 Verdecchia A, De Angelis R, Capocaccia R, et al. The cure for colon cancer: results from the EUROCARE study. *Int J Cancer* 1998; **77:** 322–29.

80 Francisci S, Capocaccia R, Grande E, et al, and the EUROCARE Working Group. The cure of cancer: a European perspective. *Eur J Cancer* 2009; **45:** 1067–79.

81 Anderson BO, Cazap E, El Saghir NS, et al. Optimisation of breast cancer management in low-resource and middle-resource countries: executive summary of the Breast Health Global Initiative consensus, 2010. *Lancet Oncol* 2011; **12:** 387–98.

82 Ferlay J, Parkin DM, Curado MP, et al. Cancer incidence in five continents, volumes I to IX: IARC CancerBase No. 9 [Internet]. http://ci5.iarc.fr (accessed Nov 14, 2013).

83 Sant M, Aareleid T, Berrino F, et al, and the EUROCARE Working Group. EUROCARE-3: survival of cancer patients diagnosed 1990-94--results and commentary. *Ann Oncol* 2003; **14** (suppl 5)**:** 61–118.

84 Quaresma M, Coleman MP, Rachet B. Funnel plots for population-based cancer survival: principles, methods and applications. *Stat Med* 2013 Sep 4. DOI:10.1002/sim.5953. [Epub ahead of print]

85 Eloranta S, Adolfsson J, Lambert PC, et al. How can we make cancer survival statistics more useful for patients and clinicians: an illustration using localized prostate cancer in Sweden. *Cancer Causes Control* 2013; **24:** 505–15.

86 World Bank. List of economies (18 July 2011). Washington DC: World Bank, 2011. http://data.worldbank.org/about/country-classifications/country-and-lending-groups (accessed Nov 14, 2013).

87 Extramural Committee to Assess Measures of Progress Against Cancer. Measurement of progress against cancer. *J Natl Cancer Inst* 1990; **82:** 825–35.

88 Karim-Kos HE, de Vries E, Soerjomataram I, et al. Recent trends of cancer in Europe: a combined approach of incidence, survival and mortality for 17 cancer sites since the 1990s. *Eur J Cancer* 2008; **44:** 1345–89.

89 Shah A, Stiller CA, Kenward MG, Vincent T, Eden TO, Coleman MP. Childhood leukaemia: long-term excess mortality and the proportion 'cured'. *Br J Cancer* 2008; **99:** 219–23.

90 Chan M. Address to WHO staff. http://www.who.int/dg/speeches/2007/address.to.staff/en/index.html (accessed Nov 14, 2013).