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Cancer Survival Group, Department of Non-Communicable Disease Epidemiology, London School of Hygiene & Tropical Medicine, Keppel Street, GB-London WC1E 7HT

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Abstract

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CONCORD-2 provided cancer survival trends for 25,676,887 patients diagnosed during the 15-year period 1995-2009 with one of 10 common cancers that collectively represented 63% of the global cancer burden in 2009.5

In this article, we summarise the past, describe the present and outline the future of the CONCORD program. We discuss the difference between population based studies and clinical trials, and we review the importance of international comparisons of population-based cancer survival. We focus on the US. We explain why population-based survival estimates are crucial for driving effective cancer control strategies to reduce the wide and persistent disparities in cancer survival between whites and blacks, which are likely to be attributable to differences in access to early diagnosis and optimal treatment.
Introduction

The CONCORD programme started in the late 1990s, with the aim of monitoring population-based cancer survival world-wide.

The first CONCORD study\(^1\) produced five-year survival estimates for almost 2 million patients diagnosed with breast, colorectal or prostate cancer during 1990-1994 and followed up to 1999. The data were provided by 101 cancer registries in 31 countries, 16 with national coverage. Global variation in survival was very wide. Survival was generally higher in North America, Australia and Japan, and in northern, western, and southern Europe, and lower in Algeria, Brazil, and eastern Europe. The CONCORD study covered 42% of the US population, and it provided the first population-based cancer survival estimates for 11 US states covered by the National Program of Cancer Registries (NPCR).

Two high-resolution studies were carried out\(^2,3\) to explain the differences in survival for breast and colorectal cancers between Europe and the US. Detailed data on stage at diagnosis, investigation and treatment were collected directly from the original medical records for about 19,000 women with breast cancer and 12,500 adults with colorectal cancer. Differences in breast cancer survival between Europe and the US were mainly explained by lower survival in Eastern Europe, where low healthcare expenditure may have constrained the quality of treatment.\(^4\) Differences in colorectal cancer survival between Europe and the US persisted into the late 1990s. They were probably attributable to earlier stage and more extensive surgery and adjuvant treatment in the US than in Europe.

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As a result, health ministers in 67 countries, home to two-thirds (4.8 billion) of the world's population, finally obtained cancer survival estimates that are methodologically rigorous and internationally comparable, to help them prioritise and formulate cancer control strategies.\(^6\) For some countries, this was the first time such data had been available.

The US Centers for Disease Control (CDC) described CONCORD-2 as the start of global surveillance of cancer survival,\(^6\) with survival estimates "that can be compared, so scientists can begin to determine why survival differs among countries. This could lead to improvements in cancer control programs." In the US, the analyses included individual data for 9,815,173 cancer patients, provided by 44 population-based cancer registries in 37 states with a total population of 257 million, doubling the population coverage of the US in the CONCORD programme to 83%.

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This Cancer Supplement presents the results of further analyses of the US data from CONCORD-2. In particular, it provides survival estimates by race (black, white) and stage at diagnosis for nine solid tumours in adults, and for acute lymphoblastic leukaemia in children, in each of the 37 participating states, for patients diagnosed 2001-2009. Separate results for the main types of leukaemia in adults will be presented in other publications.

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A report from the Institute of Medicine in 2010 commented that the system for conducting cancer clinical trials in the US was approaching a state of crisis. More than 25,000 patients were being recruited into clinical trials each year, but that still represented less than 3% of all cancer patients. The report noted that substantial progress in clinical management of various cancers had been produced by NCI-sponsored trials, but also that only about 60% were
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Differences in survival between study groups in a clinical trial are easily interpreted as being attributable to differences in the efficacy of the treatment regimens being compared, to the skill of the medical staff who designed the trial, and the rigour with which they delivered the protocol. By contrast, results from population-based studies are often profoundly misinterpreted.

International differences in population-based cancer survival may be criticised by doctors in a country or region with lower survival, on grounds such as bad data, bias or incompetent analysis, or simply dismissed out of hand as flawed or unacceptable. The unspoken fear behind some of these criticisms is the implication that the doctors in the country with lower survival are somehow being judged as less competent. This concern is misplaced.

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Population-based cancer survival estimates differ in both purpose and scope from the survival estimates derived from clinical trials, or from the patients seen by an individual clinician, clinical team, or hospital. Population-based survival estimates are designed for public health surveillance, and to inform strategic policy-making on how to improve cancer management.

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A simple thought experiment should suffice to prove this point. Even the most experienced oncological team would be unable to deliver the standard of care and the level of survival they can achieve in a developed country if they were transposed to a country where patients are seen in a hospital with no pathologist and no access to radiotherapy, where they may have had to travel for days to seek attention, and they cannot afford to return after the first surgical intervention, perhaps for vital follow-up care or chemotherapy. Seen in that context, the skills and competence of any one doctor or cancer team are part of a much wider system, in which many other elements contribute to the overall outcome for all cancer patients.

That is why the CONCORD programme for the global surveillance of population-based cancer survival is useful. It provides internationally comparable data on cancer survival trends in many countries, and for most of the common cancers. It contributes vital information to public health programmes designed to improve cancer outcomes. This Cancer Supplement offers more detailed results for the US, by race and stage at diagnosis. The results are relevant for cancer patients and public health strategy for cancer control in each state.

Studying how best to implement laboratory findings into clinical practice - “from the bench to the bedside” – may be characterised as early translational research. However, it is also important that effective new interventions identified in clinical trials become available to all patients for whom they are clinically appropriate. Public health research focusses on how best to deliver those gains as quickly as possible. This may be described as “late translational research”: from the paper to the people.

The impact of the CONCORD programme

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In September 2015, the International Atomic Energy Agency’s Programme for Action on Cancer Therapy (PACT) used CONCORD-2 results to launch an ambitious world-wide campaign to highlight the global divide in survival, and to raise awareness of persistent inequalities in access to life-saving cancer services.

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The data call was issued in May 2016, and we expect to begin producing up-to-date survival estimates from the first half of 2017. The US contribution is expected to cover up to 90% of the national population.

In a global study of this scale, good communication is vital. The data specification for CONCORD-3 has been translated from English into eight other languages: Arabic, Chinese, French, Italian, Japanese, Portuguese, Russian and Spanish. Face-to-face discussions on the protocol have been held with Canada, China, the Russian Federation, Malaysia, the UK, the US and at international meetings. The CONCORD team communicates with colleagues in six languages.

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The results of CONCORD-3 will help monitor progress toward the overarching goal of the 2013 World Cancer Declaration, to achieve major improvements in cancer survival by 2020.

**Improving cancer survival in the US**

The analyses reported in this Supplement show that by 2010, the longstanding differences in cancer survival between blacks and whites in the US had not diminished, at least up to the time when implementation of the Patient Protection and Affordable Care Act (ACA) began to improve access to health insurance, screening and cancer treatment. CDC reported in 2016 that the proportion of the US population without health insurance had dropped from 16% in 2010 to 9% by 2015, representing some 20 million people who had gained access to health insurance since introduction of the ACA. The drop was especially marked for those living below the federal poverty line, among whom the proportion uninsured fell from 29.5% to 17.2%.

One motive for producing the detailed analyses in this Supplement of cancer survival trends in the US by race, stage at diagnosis and state was to provide a baseline set of survival patterns, against which any impact of the Affordable Care Act could later be observed. As Weir and colleagues point out elsewhere in this Supplement: “the challenge [of implementation of the ACA] will be to ensure that everyone diagnosed with cancer in the United States benefits equally from advancements in medical care”.

The survival estimates from CONCORD-3 and the distributions of stage and treatment for patients diagnosed 2010-2014 will offer a preliminary evaluation of the impact of the ACA on cancer patient survival. We do not know yet how the legislation proposed to replace the ACA from 2017 will change access to health insurance, diagnostic investigation, and treatment. It
will therefore be particularly important to maintain national surveillance of cancer survival in the US beyond 2014.

References


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The results of CONCORD-3 will help monitor progress toward the overarching goal of the 2013 World Cancer Declaration, to achieve major improvements in cancer survival by 2020.

**Improving cancer survival in the US**

The analyses reported in this Supplement show that by 2010, the longstanding differences in cancer survival between blacks and whites in the US had not diminished, at least up to the time when implementation of the Patient Protection and Affordable Care Act (ACA) began to improve access to health insurance, screening and cancer treatment. CDC reported in 2016 that the proportion of the US population without health insurance had dropped from 16% in 2010 to 9% by 2015, representing some 20 million people who had gained access to health insurance since introduction of the ACA. The drop was especially marked for those living below the federal poverty line, among whom the proportion uninsured fell from 29.5% to 17.2%.

One motive for producing the detailed analyses in this Supplement of cancer survival trends in the US by race, stage at diagnosis and state was to provide a baseline set of survival patterns, against which any impact of the Affordable Care Act could later be observed. As Weir and colleagues point out elsewhere in this Supplement: “the challenge [of implementation of the ACA] will be to ensure that everyone diagnosed with cancer in the United States benefits equally from advancements in medical care”.

The survival estimates from CONCORD-3 and the distributions of stage and treatment for patients diagnosed 2010-2014 will offer a preliminary evaluation of the impact of the ACA on cancer patient survival. We do not know yet how the legislation proposed to replace the ACA from 2017 will change access to health insurance, diagnostic investigation, and treatment.
will therefore be particularly important to maintain national surveillance of cancer survival in
the US beyond 2014.

References

1. Coleman MP, Quaresma M, Berrino F, Lutz JM, De Angelis R, Capocaccia R, Baili P,
Rachet B, Gatta G, Hakulinen T, Micheli A, Sant M, Weir HK, Elwood JM, Tsukuma H,
Koifman S, Azevedo e Silva G, Francisci S, Santacquilani M, Verdecchia A, Storm HH,
Young JL, CONCORD Working Group. Cancer survival in five continents: a worldwide

Capocaccia R, Sant M, Baili P, Lombardo C, Aareleid T, Ardanaz E, Bielska-Lasota M,
Bolick S, Cress R, Elferink M, Fulton JP, Galceran J, Gozd S, Hakulinen T, Primic-
Zakelj M, Rachtan J, Diba CS, Sanchez MJ, Schymura MJ, Shen T, Tagliabue G,
Tumino R, Vercelli M, Wolf HJ, Wu XC, Coleman MP. Colorectal cancer survival in the

3. Allemani C, Sant M, Weir HK, Richardson LC, Baili P, Storm H, Siesling S, Torrella-
Cirilli C, Colonna M, Contiero P, Cress RD, Crocetti E, Fulton JP, Grosclaude P,
Hakulinen T, Izarzugaza I, Malmstrom P, Peignaux K, Primic-Zakelj M, Rachtan J,
Safaei Diba C, Sanchez MJ, Schymura MJ, Shen T, Traina A, Tryggvadottir L, Tumino
survival in the US and Europe: a CONCORD high-resolution study. Int J Cancer 2013;
132: 1170-81.


population-based registries in 67 countries (CONCORD-2). Lancet 2015; 385: 977–
1010.

2015; 385: 926-8.

7. Langmuir AD. The surveillance of communicable diseases of national importance. N

8. Coleman MP. Cancer survival: global surveillance will stimulate health policy and

the 21st century: reinvigorating the NCI Cooperative Group Program. Washington, DC:
Institute of Medicine; 2010.


11. UN Population Division. Mortality and the demographic impact of HIV/AIDS. World
population prospects: the 2004 revision. New York: UN Department of Economic and
Social Affairs; 2005: 54-82.


13. International Atomic Energy Agency. PACT’s new campaign raises awareness of the
persistent inequalities in access to lifesaving cancer services: PACT highlights the


