European Journal of Cancer 225 (2025) 115445

Contents lists available at ScienceDirect

European Journal of Cancer

journal homepage: www.ejcancer.com

Original research

Conditional survival of children, adolescents and young adults (0–24 years) diagnosed with leukaemia during 2000–2014 world-wide: (CONCORD-3)

N. Ssenyonga [a,*], CA Stiller [b], R. Marcos-Gragera [c,d,e], CE. Kuehni [f,g], N. Saint-Jacques [h], JL Bulliard [i,j], MT. Redaniel [k], K. Nakata [l], S. Schwartz [m], P. De [n], R. Ragusa [o], X. Troussard [p], MP Curado [q], F. Girardi [a,r], M. Maynadié [s], M. Valkov [t], A. Guilloteau [s], C. Lima [u,v], MP Coleman [a,w], C. Allemani [a], CONCORD Working Group [1]

[a] Cancer Survival Group, Department of Non-Communicable Disease Epidemiology, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK
[b] National Disease Registration Service, National Health Service England (NHS England), Leeds, United Kingdom
[c] Epidemiology Unit and Girona Cancer Registry, Oncology Coordination Plan, Department of Health, Autonomous Government of Catalonia, Catalan Institute of Oncology (ICO), c/ del Sol 15, Girona 17004, Spain
[d] Josep Carreras Leukaemia Research Institute (IJC), c/ del sol 15, Girona 17004, Spain
[e] Girona Biomedical Research Institute Dr. Josep Trueta (IDiBGi-CERCA), Parc Hospitalari Martí i Julià, Edifici M2, Salt 17190, Spain
[f] Swiss Childhood Cancer Registry, Institute of Social and Preventive Medicine, University of Bern, Switzerland
[g] Division of Paediatric Hematology and Oncology, Department of Paediatrics, Inselspital, Bern University Hospital, University of Bern, Switzerland
[h] Nova Scotia Health Cancer Care Program, Cancer Registry & Analytics, Nova Scotia, Canada
[i] Centre for Primary Care and Public Health (Unisanté), University of Lausanne, Lausanne, Switzerland
[j] Registre Neuchâtelois et Jurassien des Tumeurs, Switzerland
[k] National Cancer Registry of Ireland, Ireland
[l] Osaka Cancer Registry, Japan
[m] Fred Hutchinson Cancer Center, Seattle, USA
[n] Ontario Cancer Registry, Toronto, Canada
[o] Integrated Cancer Registry of Catania-Messina-Enna, Italy
[p] Registre Régional des Hémopathies Malignes de Basse Normandie, France
[q] Registro de Goiânia, Brazil
[r] Division of Medical Oncology 2, Veneto Institute of Oncology IOV-IRCCS, Via Gattamelata, Padua 64 35128, Italy
[s] Registre des Hémopathies Malignes de Côte d'Or (RHEMCO), INSERM U1231, Epi2THM team; University of Burgundy; University Hospital of Dijon, Bourgogne, France
[t] Arkhangelsk Regional Cancer Registry, Russian Federation
[u] Registro de Câncer de Base Populacional de Aracaju, Aracaju, SE, Brazil
[v] Federal University of Sergipe/Health Sciences Graduate Program, Rua Claudio Batista, Aracaju, SE S/N 49060-025, Brazil
[w] Cancer Division, University College London Hospitals NHS Foundation Trust, London, UK

ARTICLE INFO

Keywords:
Children
Adolescents
Young adults
Net survival
Population-based
Conditional survival

ABSTRACT

Background: Population-based survival estimates provide valuable insights into cancer care patterns world-wide. Access to optimal treatment leads to better outcomes, however, treatment pathways vary globally. Conditional survival is the probability that patients who have already survived for a given number of years since diagnosis will live for an additional number of years. It is a useful proxy to assess the success of initial treatment or remission of leukaemia.

Methods: We analysed data for 164,563 patients aged 0–24 years diagnosed during 2000–2014, from 258 population-based cancer registries in 61 countries. Using the Pohar-Perme estimator, we estimated net survival at five years, conditional on surviving at least one year, and at 10 years conditional on surviving five years. To control for background mortality, we used life tables of all-cause mortality by single year of age, sex, country and calendar year. All-ages survival estimates were standardised to the marginal age distribution.

Findings: During 2010–2014, age-standardised five-year conditional net survival ranged from 61.8 % in Mexico to 90 % or more in 20 countries. By 2010–2014, five-year conditional survival in most high-income countries

* Correspondence to: Cancer Survival Group, Department of Non-Communicable Disease Epidemiology, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.
E-mail address: naomi.ssenyonga@lshtm.ac.uk (N. Ssenyonga).
[1] CONCORD Working Group members are listed at the end of the article

https://doi.org/10.1016/j.ejca.2025.115445
Received 11 February 2025; Received in revised form 15 April 2025; Accepted 17 April 2025
Available online 23 May 2025

exceeded 90 % for children, but not for older patients, and for acute myeloid leukaemia it was typically 5–10 % lower than for lymphoid leukaemia. Ten-year conditional survival was 90 % or higher in most countries, with less variation world-wide.

Interpretation: World-wide variation in survival was less marked for patients who survived the first year(s) after diagnosis. Notable gains occurred in countries with initially lower five-year survival (e.g., China or Mexico), where legislative changes contributed to improved access to treatment for young patients with cancer. Nonetheless, inequalities persisted between high-income and low- and middle-income countries. Population-based cancer registry data remain essential to monitor further improvements.

Funding: Children with Cancer UK; the Institut National du Cancer, La Ligue Contre le Cancer, Centers for Disease Control and Prevention, Swiss Re, Swiss Cancer Research foundation, Swiss Cancer League, Rossy Family Foundation, US National Cancer Institute and the American Cancer Society.

1. Introduction

Cancer in young people (aged 0–24 years) is rare, but it is ranked globally as the fourth leading cause of death in adolescents and young adults [1]. Leukaemia, one of the most common childhood malignancies, also represents about 15 % of malignancies in adolescents [2]. The true burden of leukaemia in young people is not known, especially in low-income and middle-income countries [3].

Over the past decades, significant advances in treatment of cancer for young patients have led to striking improvement in outcomes, especially for children in high-income countries [4]. The third cycle of the CONCORD programme (CONCORD-3) highlighted global variations in five-year survival trends for leukaemia and its morphological sub-types for children, adolescents and young adults diagnosed during 2000–2014 [5]. By 2010–2014, for children, five-year net survival was 80 % or over in North America, Oceania and parts of Europe. Wide international variations in survival still existed, however, and survival was below 60 % in parts of Central and South America, Asia, and Europe. Nonetheless, the survival gap between high-income countries (HIC) and low-income and middle-income countries (LMIC) narrowed for children (0–14 years). Survival disparities between adolescents and children were shrinking. However, survival for young adults (20–24 years) was lowest, with persistent disparities between LMICs and HICs [5].

The poorer outcomes for adolescents and young adults are thought to be influenced by factors such as differences in the sub-types of leukaemia by age, and restricted access to appropriate treatment (i.e., paediatric vs adult protocols) [6–8]. Adolescents and young adults represent a unique demography, often experiencing delayed diagnosis or presenting with more advanced disease than children [7,9]. Further, treatment protocols and pathways vary vastly world-wide contributing to modest gains in five-year survival world-wide.

Population-based survival, measured from the time of diagnosis, is a useful indicator of the overall effectiveness of the health system, because it reflects the survival of all cancer patients [10]. Conditional survival is the probability that patients who have already survived for a given number of years since diagnosis (e.g., one or five years) will live for an additional number of years. Comparisons of these estimates remove the effect of the higher excess mortality that occurs among patients with more severe disease at diagnosis. As a result, they are useful in assessing the success of leukaemia treatment or remission.

Here, we set out to examine world-wide trends in population-based survival up to ten years for young patients diagnosed with leukaemia during 2000–2014 in 61 countries included in CONCORD-3 [5]. We also analysed trends in five-year conditional survival, among patients who survived for at least one year, and ten-year survival among patients who had survived at least five years.

2. Material and methods

Methods of data acquisition and quality control for CONCORD-3 have been described in detail [5,11]. Briefly, we used data from 258 population-based cancer registries in 61 countries and analysed anonymised individual records for 164,563 young people (aged 0–24 years) who were diagnosed with leukaemia during 2000–2014 and followed through to December 31, 2014.

Leukaemias were defined according to the International Classification of Diseases for Oncology, third edition (ICD-O-3) [12], including its first revision [13]. We included records with morphology codes in the range 9800–9992 and with behaviour code 3 (malignant). Morphology sub-groups were defined using the International Classification of Childhood Cancer (ICCC-3) [14,15], described previously [4]. Morphology was grouped as follows: lymphoid leukaemia (Ia), acute myeloid leukaemia (Ib), chronic myeloproliferative diseases (Ic), myelodysplastic syndrome and other myeloproliferative diseases (Id), and unspecified leukaemias. For lymphoid leukaemias, records were included if the anatomical site was blood, bone marrow, reticulo-endothelial, haematopoietic system not otherwise specified (C42.0–42.1, C42.3–42.4), or unknown primary site (C80.9) [4,14]. In 2010–2014, 68 % of patients were diagnosed with lymphoid leukaemia (group Ia) and 19 % acute myeloid leukaemia group (Ib) [5]. Other subtypes of leukaemia were much less common, ranging from 3.1 % to 6.5 %. This pattern was broadly consistent throughout 2000–14. Therefore, for the analysis by morphology we restricted the focus to the most common sub-types, given the limited data for other sub-types [4].

For CONCORD-3 [11], registries were asked to submit data on the first course treatment as a categorical variable (Yes, No or Unknown). This included information on whether systemic therapy was given (including chemotherapy) within the first six months after diagnosis. Details of drug regimes, dose and duration were not required.

2.1. Statistical analysis

We estimated net survival up to 10 years, by calendar period of diagnosis (2000–2004, 2005–2009 and 2010–2014), and age group.

We used the cohort approach to estimate survival for patients diagnosed during 2000–2004 and 2005–2009 because in most datasets all patients had been followed up for at least 5 years. The cohort approach provides a survival estimate for a group of patients who were diagnosed during the same year or period, are likely to have been treated in similar fashion, and who have all been followed up for at least the duration of survival required, in this case 5 years [16]. We used the period approach for patients diagnosed during 2010–2014, because 5 years of follow-up data were not available for all patients [17]. For ten-year survival, we only present net survival estimates for patients who were diagnosed during 2000–2004, using the cohort approach, as they would have had at least 10 years of follow-up.

Net survival is the cumulative probability of surviving up to a given time since diagnosis (e.g., ten years), after correcting for other causes of death (background mortality) [11]. To control for background mortality, we produced life tables of all-cause mortality rates by sex, single year of age and single calendar year in the general population of each contributing country or jurisdiction during 2000–2014, and where possible, by race/ethnicity (Israel, Singapore, USA, Northern Territory in Australia, and New Zealand) [11,18]. The method of life table construction depended on whether we received raw data (numbers of deaths and populations) or mortality rates, and on whether the raw data

or the mortality rates were by single year of age (complete) or by five-year age group (abridged). Full details on how life-tables were calculated have been published [11,18].

Net survival, with 95 % confidence intervals (CI), was estimated using the Pohar-Perme estimator [19], implemented in the Stata tool *stns* [20].

We also estimated net survival at five years conditional on surviving at least one year after diagnosis ("five-year conditional survival"), as the cumulative probability of surviving a further four years for all patients who were still alive at the end of the first year of follow-up. Similarly, net survival at 10 years, conditional on surviving at least 5 years after diagnosis ("ten-year conditional survival"), is the cumulative five-year net survival for all patients alive at the end of the fifth year of follow-up.

We grouped patients in three age categories: children (0–14 years), adolescents (15–19 years) and young adults (20–24 years). Survival estimates for all ages combined (0–24 years) were standardised by age to maximise comparability between countries and over time. Weights used for age-standardisation were based on the marginal distribution of patients in each age group (0.739, 0.136 and 0.125 for children, adolescents and young adults, respectively) [5]. To examine differences in survival by income group, we classified countries based on World Bank 2016 income classification [21]. Eighteen countries (Algeria, Nigeria, South Africa, Costa Rica, Argentina, Brazil, Peru, Colombia, Ecuador, Mexico, Jordan, Turkey, Malaysia, Thailand, China, India, Bulgaria, Russia Federation) were classified as lower-middle or upper-middle-income, all other countries were grouped as high-income.

We did not estimate survival if fewer than ten patients were available for analysis for a given combination of age, morphology sub-group and calendar period. If 10–49 patients were available, we only estimated survival for all ages combined. If 50 or more patients were available, we attempted to obtain age-standardised estimates. If a single age-specific estimate could not be obtained, we merged the data for adjacent age groups and assigned the combined estimate to both age groups before standardisation for age. If two or more age-specific estimates could not be obtained, we present only the unstandardised estimate for all ages combined. We did not merge data between consecutive calendar periods.

Survival estimates from registries where 15 % or more patients were lost to follow-up, or registered from a death certificate or at autopsy, or registered with incomplete dates, were considered less reliable. While survival estimates derived from such data are considered less than ideally reliable for international comparison, they merit inclusion here because of the paucity of survival estimates for leukaemia in children and young people from that country or region. The pooled estimates for countries with more than one registry do not include data from registries for which survival estimates were less reliable. Those estimates are shown with a flag in figures and tables when they are the only available information from a given country or territory. Where relevant, we mention in the text only reliable, age-standardised survival estimates.

2.2. Ethical approval

The Cancer Survival Group maintains approval for processing sensitive personal data for the CONCORD programme from the UK's statutory Health Research Authority (reference ECC 3–04(i)/2011; last update 18 July 2024), the National Health Service Research Ethics Service (11/LO/0331; 5 June 2024 until end of study), and the Ethics Committee of the London School of Hygiene & Tropical Medicine (28686; 3 April 2025).

3. Results

We analysed data on individual records from 121,328 (73.7 %) children, 22,963 (14.0 %) adolescents, and 20,272 (12.3 %) young adults, from 258 population-based cancer registries in 61 countries, diagnosed with leukaemia during 2000–2014. Data quality indicators and patients' characteristics have been described elsewhere [4]. Briefly, histological confirmation was assigned for virtually all patients (164, 069; 99.7 %) and overall only 4608 (2.8 %) patients were censored within 5 years of diagnosis, and 3127 (1.9 %) were lost to follow-up [4].

For all leukaemias combined, in 2010–2014, age-standardised five-year conditional net survival varied world-wide, with estimates ranging from 61.8 % in Mexico to between 90 % and 95 % in 20 countries: Puerto Rico, Canada, United States, Singapore, Australia and New Zealand; fourteen countries in Europe (Belgium, Czech Republic, Denmark, Finland, France, Germany, Ireland, Latvia, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom) (Table 1, Fig. 1). By contrast, five-year survival was at least 70 % or higher for most countries, but it was below 55 % in Mexico, Ecuador, Peru, China and India, and between 55 % and 69 % in Chile, Brazil and the Russia Federation (Table 1, Fig. 1).

Increases of 20 % or more in five-year conditional survival than five-year survival was present in China (51.8 % vs. 76.1 %), Ecuador (46.8 % vs. 72.7 %), and Russia Federation (62.9 % vs. 85.3 %) (Table 1, Fig. 1). Nonetheless, in majority of these countries, five-year conditional net survival estimates were still below 80 % (Table 1, Fig. 1). Furthermore, five-year conditional survival among individuals who had survived to their first anniversary since diagnosis was 5–10 % higher than five-year survival for 23 countries in Europe, North America and Oceania. Regional variation in survival Europe reduced when taking into account the effect of surviving the first year of diagnosis. The absolute difference between highest and lowest five-year survival of 30 % shrank to 5 % if individuals survived their first year since diagnosis, the improvement was more marked for Eastern Europe countries such as Bulgaria and Russia Federation (Table 1, Fig. 1).

Survival varied by morphological sub-type, in 2010–2014, five-year net survival for children, adolescents and young adults diagnosed with lymphoid leukaemia was 80 % or higher in most parts of Europe, North America and Oceania (Supplementary Table 1, Fig. 2). When restricting the analysis to patients with lymphoid leukaemia who were alive after one year of follow-up, 26 countries saw increases in survival between 5 % and 10 %, majority based in Europe, America (North), Oceania and parts of Asia (Supplementary Table 1 Fig. 2). By contrast, in the great majority of countries five-year net survival for patients with acute myeloid leukaemia was at least 10 % lower than for patients with lymphoid leukaemia, but conditional survival for acute myeloid leukaemia was typically 5–10 % lower than for lymphoid leukaemia. For those alive after one year of follow-up, substantial absolute increases of 25 % or more were noted in six countries namely; Mexico (30.3 *vs* 55.7 %), Puerto Rico (66.0 *vs* 100.0 %), China (43.3 *vs* 79.1 %), Bulgaria (57.7 *vs* 83.7 %), Czech Republic (53.7 *vs* 84.7 %) and Spain (53.7 *vs* 83.2 %) (Supplementary Table 1, Fig. 2). Most countries based in Europe, North America, Oceania and Asia saw increases of 10 % or more. Nevertheless, survival estimates for acute myeloid leukaemia were wide-ranging and less precise than those for lymphoid leukaemia because the estimates were based on lower numbers of patients.

Survival differed by age at diagnosis, we found that in 2010–2014, five-year net survival conditional on surviving one year was highest for children (0–14 years), exceeding 90 % in most of North America, Oceania and Europe, (Supplementary Table 2, Fig. 2). For adolescents (15–19 years), five-year conditional survival ranged from below 50 % in Colombia and Mexico to 90 % or higher in seven countries (Canada, Singapore, Denmark, Switzerland, Lithuania, Ireland and Slovenia). For young adults (20–24 years), five-year conditional survival ranged from 58 % in Costa Rica to over 90 % in two countries Ireland and Norway (Supplementary Table 2, Supplementary Figure 1). The absolute difference between the oldest (20–24 years) and youngest (0–14 years) age group ranged between 10 % and 25 % in 21 countries (Argentina, Peru, Puerto Rico, Canada, United States, China, Israel, Korea, Kuwait, Thailand, Turkey, Austria, Bulgaria, Croatia, Czech Republic, Lithuania, Poland, Portugal, Russian Federation, Switzerland and New Zealand; the difference was greater than 25 % in Costa Rica and Malaysia

Table 1
Age-standardised 1-year, 5-year and 5-year conditional net survival (NS, %):children, adolescents and young adults (0-24 years) diagnosed with all leukaemias combined, by country and calendar period of diagnosis.

	Period of diagnosis	1-year survival		5-year survival		5-year conditional survival		
		No.	NS (%)	95% CI	NS (%)	95% CI	No.	NS (%)	95% CI
AFRICA									
Algeria	**2000-2004**	101	**57.0§**	**46.6 - 67.5**	**7.8 §**	**0.3 - 15.3**	47	*7.9 §*	**0.0 - 18.0**
(2 registries)	**2005-2009**	64	**79.8 §**	**69.5 - 90.1**	**55.6 §**	**41.8 - 69.4**	28	*48.8 §*	*20.3 - 77.4*
	2010-2014	40	*76.7 §*	*49.7 - 100.0*	*28.8 §*	*0.0 - 69.3*	15	*37.5 §*	*0.0 - 78.7*
South Africa	**2000-2004**	20	*76.4*	*39.2 - 100.0*	*76.4*	*39.2 - 100.0*	3		
(Eastern Cape)	**2005-2009**	14	*80.2*	*48.8 - 100.0*	*80.2*	*48.8 - 100.0*	2		
	2010-2014	10	*100.0*	*100.0 - 100.0*	*75.3*	*38.4 - 100.0*	6		
AMERICA (CENTRAL AND SOUTH)									
‡Argentina	**2000-2004**	2,321	**75.4**	**71.7 - 79.1**	**59.9**	**55.0 - 64.7**	1,792	*79.5*	*77.6 - 81.4*
(4 registries)	**2005-2009**	2,341	**77.7**	**74.9 - 80.6**	**62.3**	**59.2 - 65.3**	1,890	**79.4**	**76.0 - 82.8**
	2010-2014	1,998	**81.5 §**	**78.0 - 85.0**	**67.2 §**	**63.5 - 70.9**	1,545	**82.9 §**	**78.9 - 86.9**
Brazil	**2000-2004**	182	**81.1**	**75.6 - 86.5**	**62.4**	**55.5 - 69.3**	145	*89.4*	*78.0 - 100.0*
(4 registries)	**2005-2009**	209	**78.3**	**73.1 - 83.6**	**60.4**	**54.3 - 66.6**	165	*76.7*	*64.7 - 88.7*
	2010-2014	123	**83.9**	**77.7 - 90.0**	**65.7**	**58.0 - 73.4**	97		
Chile	**2000-2004**	67	*81.9*	*72.7 - 91.1*	*59.2*	*47.4 - 70.9*	54	*72.3*	*60.5 - 84.1*
(4 registries)	**2005-2009**	199	**78.5**	**72.9 - 84.0**	**60.2**	**53.6 - 66.8**	152	**76.0**	**69.3 - 82.6**
	2010-2014	59	**80.7**	**71.9 - 89.5**	**58.7**	**49.5 - 68.0**	43	*75.9*	*68.0 - 83.9*
Colombia	**2000-2004**	273	**67.7**	**62.0 - 73.3**	**42.3**	**36.3 - 48.4**	162	*86.4*	*72.2 - 100.0*
(3 registries)	**2005-2009**	231	**73.8**	**68.2 - 79.4**	**50.6**	**43.9 - 57.3**	156	*84.8*	*72.1 - 97.5*
	2010-2014	102	**75.8 §**	**62.8 - 88.9**	**49.8 §**	**36.7 - 62.9**	41	*76.8 §*	*57.2 - 96.5*
Costa Rica*	**2000-2004**	208	**92.4**	**89.1 - 95.7**	**78.7**	**74.3 - 83.0**	192	**83.2**	**78.4 - 88.1**
	2005-2009	372	**90.7**	**87.6 - 93.7**	**76.2**	**72.2 - 80.2**	340	**83.1**	**79.0 - 87.3**
	2010-2014	357	**89.2**	**86.0 - 92.5**	**73.6**	**69.3 - 77.9**	271	**84.4**	**80.4 - 88.4**
Ecuador	**2000-2004**	301	**65.7 §**	**60.4 - 71.0**	**41.9 §**	**36.2 - 47.6**	180	**63.4 §**	**56.3 - 70.5**
(5 registries)	**2005-2009**	575	**68.7**	**64.9 - 72.5**	**47.2**	**43.0 - 51.3**	376	**67.8**	**63.0 - 72.6**
	2010-2014	590	**68.4**	**64.6 - 72.2**	**46.8**	**42.6 - 51.1**	390	**72.7**	**68.0 - 77.3**
Guadaeloupe	**2000-2004**								
	2005-2009	10	*100.0*	*100.0 - 100.0*	*100.0*	*100.0 - 100.0*	5		
	2010-2014	12	*55.6*	*20.7 - 90.6*	*55.6*	*20.7 - 90.6*	5		
Martinique*	**2000-2004**	18	*88.5*	*74.0 - 100.0*	*71.0*	*50.1 - 91.8*	15	*80.1*	*60.6 - 99.7*
	2005-2009	21	*85.8*	*71.2 - 100.0*	*75.4*	*57.0 - 93.8*	18	*87.9*	*72.6 - 100.0*
	2010-2014	12	*92.3*	*78.4 - 100.0*	*82.2*	*60.5 - 100.0*	12	*89.0 §*	*69.7 - 100.0*
‡Mexico Childhood	**2000-2004**								
	2005-2009	1,953	*50.4*	*47.9 - 52.8*	**45.4**	**43.1 - 47.7**	1,353	**62.7**	**60.0 - 65.4**
	2010-2014	5,408	*77.0*	*75.8 - 78.3*	**45.5**	**42.6 - 48.4**	2,988	**61.8**	**57.9 - 65.7**
Peru	**2000-2004**								
(Lima)	**2005-2009**								
	2010-2014	570	**74.8**	**71.2 - 78.5**	**52.1**	**47.3 - 56.8**	397	**68.8**	**63.5 - 74.1**
Puerto Rico *	**2000-2004**	215	**85.2**	**80.7 - 89.7**	**68.4**	**62.6 - 74.2**	182	**79.2**	**73.5 - 84.9**
	2005-2009	185	**86.2**	**81.5 - 90.9**	**74.6**	**68.8 - 80.3**	156	**85.4**	**80.4 - 90.5**
	2010-2014	106	**87.9**	**81.8 - 94.0**	**81.8**	**74.9 - 88.7**	94	**94.5**	**89.5 - 99.6**
AMERICA (NORTH)									
Canada	**2000-2004**	1,931	**89.9**	**88.2 - 91.5**	**81.3**	**79.2 - 83.5**	1,739	**90.2**	**88.4 - 92.0**
(10 registries)	**2005-2009**	2,014	**92.8**	**91.4 - 94.2**	**85.0**	**83.0 - 86.9**	1,864	**91.4**	**89.8 - 93.0**
	2010-2014	2,105	**93.2**	**91.7 - 94.7**	**86.0**	**84.0 - 88.0**	1,616	**93.1**	**91.7 - 94.6**
United States	**2000-2004**	17,475	**89.3**	**88.8 - 89.7**	**76.7**	**76.1 - 77.3**	15,529	**85.5**	**84.9 - 86.0**
(49 registries)	**2005-2009**	19,221	**91.0**	**90.6 - 91.4**	**80.8**	**80.3 - 81.4**	17,386	**88.6**	**88.1 - 89.0**
	2010-2014	15,550	**92.4**	**92.0 - 92.8**	**83.3**	**82.7 - 83.8**	12,621	**91.1**	**90.7 - 91.6**
ASIA									
China	**2000-2004**	365	**53.8**	**48.2 - 59.5**	**38.1**	**32.5 - 43.7**	193	**70.2**	**63.2 - 77.3**
(21 registries)	**2005-2009**	1,080	**63.4**	**60.1 - 66.7**	**46.3**	**42.9 - 49.7**	658	**71.5**	**67.9 - 75.2**
	2010-2014	880	**69.4**	**66.2 - 72.7**	**51.8**	**48.1 - 55.4**	606	**76.1**	**72.4 - 79.8**

(*continued on next page*)

Table 1 (*continued*)

		Period of diagnosis		1-year survival		5-year survival		5-year conditional survival		
			No.	NS (%)	95% CI	NS (%)	95% CI	No.	NS (%)	95% CI
	Cyprus*	**2000-2004**	14	*71.4*	*48.8 - 94.1*	*64.3*	*40.3 - 88.3*	7		
		2005-2009	50	*88.0*	*79.1 - 96.9*	*74.0*	*62.0 - 86.1*	24	*84.1* §	*73.4 - 94.8*
		2010-2014	47	**95.8**	**90.7 - 100.0**	**87.3**	**78.3 - 96.3**	34	**91.4 §**	**84.5 - 98.3**
	India	**2000-2004**	25	*56.1*	*37.1 - 75.0*	*44.3*	*25.4 - 63.3*	14	*79.0*	*58.2 - 99.7*
	(2 registries)	**2005-2009**	84	*70.5*	*53.6 - 87.4*	*48.5*	*30.1 - 67.0*	60	*68.8*	*48.5 - 89.2*
		2010-2014	59	**73.0**	**58.0 - 88.0**	**50.0**	**32.8 - 67.1**	36	*73.0*	*54.7 - 91.3*
	Israel *	**2000-2004**	545	**88.5**	**85.9 - 91.2**	**77.0**	**73.6 - 80.4**	481	**86.7**	**83.8 - 89.7**
		2005-2009	558	**89.8**	**87.3 - 92.3**	**78.5**	**75.2 - 81.9**	501	**87.3**	**84.5 - 90.2**
		2010-2014	469	**89.1**	**86.2 - 91.9**	**79.7**	**76.1 - 83.3**	423	**89.6**	**86.6 - 92.5**
	Japan	**2000-2004**	908	**88.3**	**86.2 - 90.3**	**69.6**	**66.6 - 72.5**	764	**78.3**	**75.5 - 81.2**
	(16 registries)	**2005-2009**	1,579	**89.5**	**88.0 - 91.0**	**75.1**	**73.0 - 77.3**	1,341	**83.6**	**81.6 - 85.5**
		2010-2014	1,094	**94.0**	**92.6 - 95.4**	**80.7**	**78.4 - 82.9**	996	**87.4**	**85.6 - 89.2**
	Jordan *	**2000-2004**	482	**84.7 §**	**81.4 - 88.0**	**69.5 §**	**65.2 - 73.8**	374	**81.8 §**	**77.9 - 85.8**
		2005-2009	479	**86.7 §**	**83.8 - 89.7**	**78.5 §**	**74.9 - 82.1**	410	**90.1 §**	**87.2 - 93.0**
		2010-2014	461	**85.3 §**	**82.2 - 88.4**	**74.1 §**	**70.2 - 78.0**	324	**88.3 §**	**85.1 - 91.5**
	Korea *	**2000-2004**	2,974	**80.0**	**78.5 - 81.4**	**61.2**	**59.5 - 63.0**	2,342	**76.2**	**74.5 - 77.9**
		2005-2009	2,966	**84.3**	**82.9 - 85.6**	**69.3**	**67.7 - 71.0**	2,486	**82.3**	**80.8 - 83.8**
		2010-2014	2,880	**89.9**	**88.8 - 91.0**	**76.5**	**75.0 - 78.1**	2,051	**87.0**	**85.7 - 88.3**
	Kuwait *	**2000-2004**	127	**88.6**	**83.6 - 93.5**	**79.6**	**73.0 - 86.3**	108	**90.3**	**84.9 - 95.7**
		2005-2009	152	**87.4**	**82.2 - 92.6**	**74.6**	**67.7 - 81.4**	132	**84.9**	**78.8 - 91.0**
		2010-2014	112	**88.4**	**82.8 - 93.9**	**77.7**	**70.8 - 84.6**	99	**89.9**	**84.2 - 95.6**
	Malaysia	**2000-2004**								
	(Penang)	**2005-2009**	141	**76.7**	**68.1 - 85.4**	**63.9**	**54.3 - 73.5**	86	*83.4* §	*74.5 - 92.3*
		2010-2014	119	**78.8**	**71.9 - 85.7**	**68.3**	**60.7 - 75.9**	94	**88.2 §**	**82.8 - 93.7**
	Qatar*	**2000-2004**	48	*80.7*	*68.5 - 92.8*	*57.4*	*39.8 - 75.0*	21	*71.2* §	*52.2 - 90.2*
		2005-2009	58	**84.6**	**72.8 - 96.4**	**76.2**	**60.2 - 92.3**	26	*91.1* §	*79.3 - 100.0*
		2010-2014	69	**93.7**	**90.8 - 96.7**	**81.1**	**64.1 - 98.0**	21	**81.2 §**	**66.5 - 95.9**
	Singapore *	**2000-2004**	245	**86.1**	**81.8 - 90.4**	**68.4**	**62.8 - 74.1**	211	**78.3**	**72.9 - 83.8**
		2005-2009	244	**90.7**	**87.2 - 94.2**	**80.1**	**75.4 - 84.9**	220	**87.4**	**83.1 - 91.7**
		2010-2014	228	**92.0**	**88.5 - 95.4**	**84.0**	**79.4 - 88.6**	173	**93.3**	**90.1 - 96.6**
	Taiwan *	**2000-2004**	1,439	**83.1**	**81.2 - 85.1**	**61.6**	**59.1 - 64.0**	1,187	**73.6**	**71.2 - 76.0**
		2005-2009	1,340	**86.5**	**84.7 - 88.3**	**69.9**	**67.4 - 72.3**	1,148	**80.6**	**78.4 - 82.9**
		2010-2014	1,224	**89.3**	**87.6 - 91.0**	**71.7**	**69.2 - 74.2**	876	**81.9**	**79.6 - 84.2**
	Thailand	**2000-2004**	464	**59.2 §**	**54.8 - 63.7**	**37.9 §**	**33.4 - 42.3**	257	**62.7 §**	**56.8 - 68.7**
	(6 registries)	**2005-2009**	624	**66.8**	**63.1 - 70.4**	**44.5**	**40.7 - 48.4**	407	**65.8**	**61.2 - 70.4**
		2010-2014	499	**74.0 §**	**70.2 - 77.8**	**54.0 §**	**49.7 - 58.2**	297	**74.6 §**	**70.3 - 78.8**
	Turkey	**2000-2004**	259	**72.3 §**	**66.9 - 77.7**	**59.7 §**	**53.7 - 65.6**	174	**81.3 §**	**75.7 - 87.0**
	(8 registries)	**2005-2009**	1,205	**82.1**	**79.9 - 84.3**	**68.5**	**65.8 - 71.1**	968	**83.1**	**80.8 - 85.5**
		2010-2014	1,208	**86.4**	**84.6 - 88.3**	**72.1**	**69.7 - 74.5**	1,024	**85.0**	**83.0 - 87.1**
EUROPE										
	Austria *	**2000-2004**	663	**89.6**	**86.7 - 92.6**	**78.0**	**74.8 - 81.3**	602	**86.6**	**83.6 - 89.6**
		2005-2009	723	**91.1**	**88.6 - 93.7**	**81.5**	**78.5 - 84.5**	677	**88.5**	**85.7 - 91.3**
		2010-2014	719	**92.9**	**90.6 - 95.2**	**82.7**	**79.8 - 85.7**	570	**89.9**	**87.3 - 92.6**
	‡Belarus Childhood	**2000-2004**	326	*82.9*	*78.8 - 86.9*	*71.6*	*66.7 - 76.5*	270	*86.4*	*82.3 - 90.5*
		2005-2009	285	*89.5*	*86.0 - 93.1*	*80.8*	*76.2 - 85.4*	255	*90.3*	*88.6 - 91.7*
		2010-2014	362	*91.6*	*88.7 - 94.5*	*83.9*	*80.0 - 87.9*	257	*92.8*	*89.9 - 95.8*
	Belgium *	**2000-2004**	119	**89.0**	**83.3 - 94.6**	**78.9**	**71.7 - 86.1**	105	**88.8**	**83.0 - 94.5**
		2005-2009	583	**91.3**	**89.1 - 93.6**	**81.1**	**78.0 - 84.2**	524	**88.7**	**86.0 - 91.3**
		2010-2014	668	**93.7**	**91.8 - 95.6**	**85.1**	**82.3 - 87.9**	492	**91.6**	**89.3 - 93.8**
	Bulgaria*	**2000-2004**	289	**75.9**	**71.1 - 80.7**	**50.9**	**45.3 - 56.6**	218	**66.9**	**60.8 - 73.1**
		2005-2009	384	**80.3**	**76.4 - 84.1**	**66.3**	**61.7 - 70.8**	304	**81.7**	**77.5 - 86.0**
		2010-2014	304	**85.3**	**81.6 - 89.0**	**71.7**	**67.0 - 76.4**	208	**84.4**	**80.1 - 88.6**

(*continued on next page*)

Table 1 (*continued*)

	Period of diagnosis		1-year survival		5-year survival		5-year conditional survival		
		No.	NS (%)	95% CI	NS (%)	95% CI	No.	NS (%)	95% CI
Croatia*	**2000-2004**	278	**88.4**	**84.7 - 92.0**	**75.8**	**71.1 - 80.6**	246	**85.2**	**80.9 - 89.6**
	2005-2009	239	**84.6**	**80.2 - 89.1**	**73.8**	**68.5 - 79.1**	202	**86.4**	**81.7 - 91.1**
	2010-2014	217	**86.5**	**82.1 - 90.9**	**76.1**	**70.9 - 81.3**	150	**87.7**	**83.2 - 92.2**
Czech Republic*	**2000-2004**	370	**84.2**	**80.7 - 87.8**	**75.8**	**71.7 - 79.9**	308	**89.1**	**85.8 - 92.4**
	2005-2009	379	**85.9**	**82.6 - 89.2**	**78.3**	**74.4 - 82.2**	321	**90.6**	**87.5 - 93.6**
	2010-2014	267	**88.9**	**85.1 - 92.6**	**79.6**	**75.2 - 84.0**	211	**90.7**	**87.6 - 93.8**
Denmark*	**2000-2004**	346	**91.6**	**88.6 - 94.6**	**80.4**	**76.1 - 84.7**	317	**87.8**	**84.2 - 91.5**
	2005-2009	330	**91.5**	**88.5 - 94.5**	**83.4**	**79.5 - 87.3**	300	**91.1**	**87.9 - 94.3**
	2010-2014	364	**94.4**	**92.0 - 96.7**	**87.3**	**83.8 - 90.8**	292	**92.4**	**89.5 - 95.4**
Estonia*	**2000-2004**	68	**78.8**	**70.0 - 87.6**	**51.6**	**40.7 - 62.5**	53	64.3	51.5 - 77.0
	2005-2009	77	**88.8**	**81.8 - 95.8**	**75.2**	**66.1 - 84.4**	68	**84.5**	**76.8 - 92.3**
	2010-2014	42	**89.1**	**80.1 - 98.0**	**70.7**	**58.5 - 82.9**	38	**86.2**	**76.7 - 95.6**
Finland *	**2000-2004**	322	**92.8**	**90.0 - 95.6**	**80.4**	**76.1 - 84.7**	299	**86.5**	**82.7 - 90.4**
	2005-2009	354	**92.5**	**89.8 - 95.3**	**82.3**	**78.3 - 86.2**	327	**88.8**	**85.4 - 92.3**
	2010-2014	312	**95.2**	**92.8 - 97.5**	**86.5**	**82.8 - 90.2**	235	**91.2**	**88.0 - 94.3**
‡France	**2000-2004**	2,625	**91.6**	**90.2 - 93.1**	**79.3**	**77.2 - 81.4**	2,430	**86.4**	**84.5 - 88.3**
(15 registries)	**2005-2009**	2,671	**92.3**	**90.9 - 93.6**	**83.1**	**81.2 - 85.0**	2,457	**89.6**	**87.8 - 91.3**
	2010-2014	1,587	**92.7**	**90.3 - 95.1**	**83.4**	**80.6 - 86.3**	1,434	**90.9**	**88.8 - 93.0**
Germany	**2000-2004**	804	**91.3**	**89.2 - 93.4**	**81.4**	**78.8 - 84.1**	709	**88.7**	**86.4 - 91.0**
(10 registries)	**2005-2009**	1,166	**93.4**	**91.9 - 94.9**	**84.6**	**82.6 - 86.7**	1,070	**90.6**	**88.8 - 92.3**
	2010-2014	824	**93.9**	**92.4 - 95.4**	**84.4**	**82.1 - 86.8**	637	**90.7**	**88.8 - 92.7**
‡Greece National Paediatric	**2000-2004**	399	*90.0*	*87.1 - 92.9*	*81.2*	*77.4 - 85.1*	359	*90.3*	*87.2 - 93.4*
	2005-2009	411	*93.4*	*91.1 - 95.8*	*83.0*	*79.4 - 86.7*	384	*89.2*	*87.2 00.0 90.5*
	2010-2014	480	*90.8*	*88.1 - 93.4*	*81.7*	*78.1 - 85.2*	336	*90.0*	*88.6 00.0 91.2*
Iceland*	**2000-2004**	16	*100.0*	*79.4 - 100.0*	*81.3*	*62.8 - 99.8*	16	*81.3*	*62.8 - 99.8*
	2005-2009	26	*84.6*	*71.1 - 98.2*	*77.0*	*61.1 - 92.8*	22	*90.9*	*79.2 - 100.0*
	2010-2014	20	*95.8*	*88.0 - 100.0*	**92.0**	**81.8 - 100.0**	16	*95.7*	*87.6 - 100.0*
Ireland*	**2000-2004**	271	**84.9**	**80.7 - 89.1**	**73.8**	**68.6 - 78.9**	229	**86.7**	**82.4 - 91.1**
	2005-2009	297	**91.3**	**88.1 - 94.4**	**84.6**	**80.5 - 88.7**	270	**92.7**	**89.5 - 95.8**
	2010-2014	241	**89.9**	**86.2 - 93.6**	**83.7**	**79.1 - 88.2**	219	**95.2**	**92.4 - 98.0**
Italy	**2000-2004**	1,247	**90.6**	**89.0 - 92.2**	**78.5**	**76.2 - 80.8**	1,123	**86.5**	**84.5 - 88.5**
(44 registries)	**2005-2009**	1,757	**92.7**	**91.4 - 93.9**	**82.2**	**80.4 - 84.0**	1,613	**88.7**	**87.1 - 90.2**
	2010-2014	714	**93.4**	**91.6 - 95.2**	**82.8**	**80.3 - 85.2**	654	**89.7**	**87.8 - 91.6**
Latvia*	**2000-2004**	100	**82.6**	**75.4 - 89.8**	**68.1**	**59.7 - 76.5**	82	**82.3**	**75.4 - 89.1**
	2005-2009	75	**83.9**	**76.4 - 91.3**	**73.1**	**64.2 - 82.0**	63	**87.0**	**79.3 - 94.7**
	2010-2014	87	**91.8**	**86.0 - 97.6**	**81.9**	**73.7 - 90.1**	53	**90.8**	**84.5 - 97.2**
Lithuania*	**2000-2004**	196	**78.0**	**72.2 - 83.7**	**62.1**	**55.4 - 68.9**	152	**79.8**	**73.4 - 86.1**
	2005-2009	169	**79.1**	**73.1 - 85.2**	**69.2**	**62.2 - 76.1**	131	**87.4**	**81.8 - 93.1**
	2010-2014	115	**84.2**	**77.4 - 91.1**	**73.4**	**65.1 - 81.6**	98	**88.5**	**82.2 - 94.8**
Malta*	**2000-2004**	32	*90.6*	*80.7 - 100.0*	*65.7*	*49.5 - 81.8*	29	*72.5*	*56.5 - 88.4*
	2005-2009	31	*87.1*	*75.5 - 98.7*	*74.2*	*59.1 - 89.4*	27	*85.2*	*72.1 - 98.4*
	2010-2014	15	*75.1*	*54.8 - 95.5*	*66.7*	*45.7 - 87.8*	11	*88.8*	*74.6 - 100.0*
Netherlands*	**2000-2004**	982	**89.1**	**87.1 - 91.1**	**75.8**	**73.1 - 78.4**	879	**84.7**	**82.3 - 87.1**
	2005-2009	981	**89.9**	**88.0 - 91.8**	**80.3**	**77.8 - 82.8**	878	**89.2**	**87.2 - 91.2**
	2010-2014	863	**91.2**	**89.4 - 93.0**	**83.7**	**81.4 - 86.1**	676	**92.4**	**90.6 - 94.1**
Norway*	**2000-2004**	282	**93.5**	**90.6 - 96.4**	**77.3**	**72.4 - 82.2**	264	**82.4**	**77.7 - 87.1**
	2005-2009	295	**92.2**	**89.2 - 95.3**	**83.1**	**78.8 - 87.3**	271	**90.0**	**86.5 - 93.6**
	2010-2014	323	**91.6**	**88.6 - 94.7**	**82.0**	**77.8 - 86.3**	240	**90.1**	**86.7 - 93.6**
Poland	**2000-2004**	1,631	**82.2**	**80.4 - 84.1**	**67.1**	**64.9 - 69.3**	1,327	**80.9**	**78.9 - 83.0**
(16 registries)	**2005-2009**	1,793	**86.9**	**85.4 - 88.5**	**74.9**	**72.9 - 76.8**	1,547	**86.1**	**84.4 - 87.8**
	2010-2014	1,579	**90.2**	**88.8 - 91.6**	**79.5**	**77.6 - 81.4**	1,152	**88.8**	**87.3 - 90.4**
Portugal	**2000-2004**	497	**88.8**	**86.1 - 91.5**	**71.2**	**67.4 - 75.0**	438	**79.7**	**76.1 - 83.3**
(4 registries)	**2005-2009**	503	**91.2**	**88.7 - 93.7**	**79.8**	**76.3 - 83.2**	455	**87.4**	**84.3 - 90.4**
	2010-2014	281	**92.8**	**88.4 - 97.2**	**79.4**	**72.2 - 86.7**	219	**85.6**	**79.0 - 92.2**

(*continued on next page*)

Table 1 (*continued*)

		Period of diagnosis		1-year survival		5-year survival		5-year conditional survival		
			No.	NS (%)	95% CI	NS (%)	95% CI	No.	NS (%)	95% CI
	Romania	**2000-2004**								
	(Cluj)	**2005-2009**	16	*62.5*	*40.2 - 84.8*	*62.5*	*40.2 - 84.8*	10	*100.0*	*69.2 - 100.0*
		2010-2014	27	*63.1*	*45.2 - 80.9*	*63.1*	*45.2 - 80.9*	18	*94.6*	*84.3 - 100.0*
	Russian Federation	**2000-2004**	235	**70.8**	**64.8 - 76.8**	**57.4**	**51.0 - 63.7**	159	**82.0**	**76.2 - 87.9**
	(3 registries)	**2005-2009**	235	**76.5**	**71.0 - 82.0**	**61.5**	**55.6 - 67.5**	178	**78.3**	**72.5 - 84.0**
		2010-2014	227	**76.8**	**70.8 - 82.8**	**62.9**	**56.7 - 69.2**	137	**85.3**	**80.1 - 90.6**
	Slovakia*	**2000-2004**	266	**82.1**	**77.4 - 86.7**	**69.8**	**64.3 - 75.3**	217	**85.0**	**80.3 - 89.6**
		2005-2009	304	**86.9**	**83.2 - 90.6**	**73.4**	**68.5 - 78.3**	261	**84.2**	**79.8 - 88.6**
		2010-2014	61	**88.9**	**80.8 - 97.1**	**76.6**	**65.5 - 87.7**	57	**86.3**	**76.8 - 95.7**
	Slovenia*	**2000-2004**	90	**88.0**	**81.9 - 94.1**	**77.5**	**69.5 - 85.4**	78	**88.1**	**84.9 - 90.8**
		2005-2009	104	**85.9**	**79.4 - 92.4**	**74.6**	**66.3 - 82.9**	88	**86.5**	**79.4 - 93.6**
		2010-2014	84	**93.5**	**88.4 - 98.6**	**79.6**	**70.8 - 88.4**	78	**85.0**	**76.8 - 93.3**
	Spain	**2000-2004**	802	**86.1**	**83.5 - 88.6**	**71.7**	**68.5 - 75.0**	696	**83.2**	**80.2 - 86.2**
	(11 registries)	**2005-2009**	1,027	**89.0**	**87.0 - 90.9**	**77.7**	**75.1 - 80.3**	910	**87.3**	**85.0 - 89.5**
		2010-2014	773	**87.3**	**84.0 - 90.6**	**77.8**	**73.7 - 81.9**	501	**91.3**	**88.2 - 94.5**
	Sweden*	**2000-2004**	529	**91.2**	**88.7 - 93.6**	**79.9**	**76.5 - 83.3**	483	**87.5**	**84.6 - 90.5**
		2005-2009	497	**90.0**	**87.4 - 92.6**	**81.4**	**78.0 - 84.8**	447	**90.4**	**87.7 - 93.1**
		2010-2014	584	**92.1**	**89.9 - 94.3**	**83.3**	**80.2 - 86.4**	420	**91.7**	**89.3 - 94.1**
	‡Switzerland	**2000-2004**	355	**92.7**	**89.8 - 95.5**	**78.4**	**73.8 - 83.0**	325	**84.6**	**80.4 - 88.8**
	(10 registries)	**2005-2009**	330	**94.7**	**92.0 - 97.3**	**86.0**	**82.0 - 89.9**	314	**90.7**	**87.3 - 94.1**
		2010-2014	407	**91.6**	**88.2 - 94.9**	**85.2**	**81.1 - 89.3**	315	**93.3**	**90.3 - 96.3**
	United Kingdom	**2000-2004**	3,397	**89.6**	**88.5 - 90.6**	**76.7**	**75.3 - 78.1**	3,009	**85.3**	**84.0 - 86.5**
	(4 registries)	**2005-2009**	3,506	**91.5**	**90.6 - 92.4**	**83.0**	**81.8 - 84.2**	3,167	**90.6**	**89.6 - 91.6**
		2010-2014	3,721	**92.4**	**91.6 - 93.3**	**84.6**	**83.4 - 85.7**	2,701	**92.3**	**91.4 - 93.2**
OCEANIA										
	Australia *	**2000-2004**	1,543	**91.6**	**90.2 - 93.0**	**80.7**	**78.8 - 82.7**	1,413	**88.0**	**86.3 - 89.7**
	(8 registries)	**2005-2009**	1,596	**93.2**	**92.0 - 94.4**	**84.5**	**82.8 - 86.2**	1,480	**90.4**	**88.9 - 91.9**
		2010-2014	1,520	**94.4**	**93.2 - 95.5**	**87.7**	**86.0 - 89.4**	1,101	**93.9**	**92.7 - 95.2**
	New Zealand *	**2000-2004**	321	**89.9**	**86.7 - 93.2**	**77.7**	**73.3 - 82.1**	289	**85.9**	**81.9 - 89.9**
		2005-2009	331	**93.1**	**90.5 - 95.7**	**84.9**	**81.1 - 88.6**	306	**91.0**	**87.9 - 94.2**
		2010-2014	301	**93.0**	**90.3 - 95.7**	**84.0**	**80.2 - 87.8**	258	**91.2**	**88.2 - 94.2**

Italics denote survival estimates that are not age-standardised; bold indicates age-standardised survival estimates

"five-year conditional survival" - net survival at five years conditional on surviving at least one year after diagnosis

§ Survival estimate considered less reliable, because 15% or more of patients were (a) lost to follow-up or censored alive within five years of diagnosis (or if diagnosed in 2010 or later, before 31 December 2014), or (b) registered only from a death certificate or at autopsy, or (c) registered with incomplete dates, i.e., unknown year of birth, unknown month and/or year of diagnosis or unknown year of last vital status

* Data with 100% coverage of the national population; ‡Data with 100% coverage of the national population for childhood cancers only, data for 15-24 years old are from registries with sub-national coverage

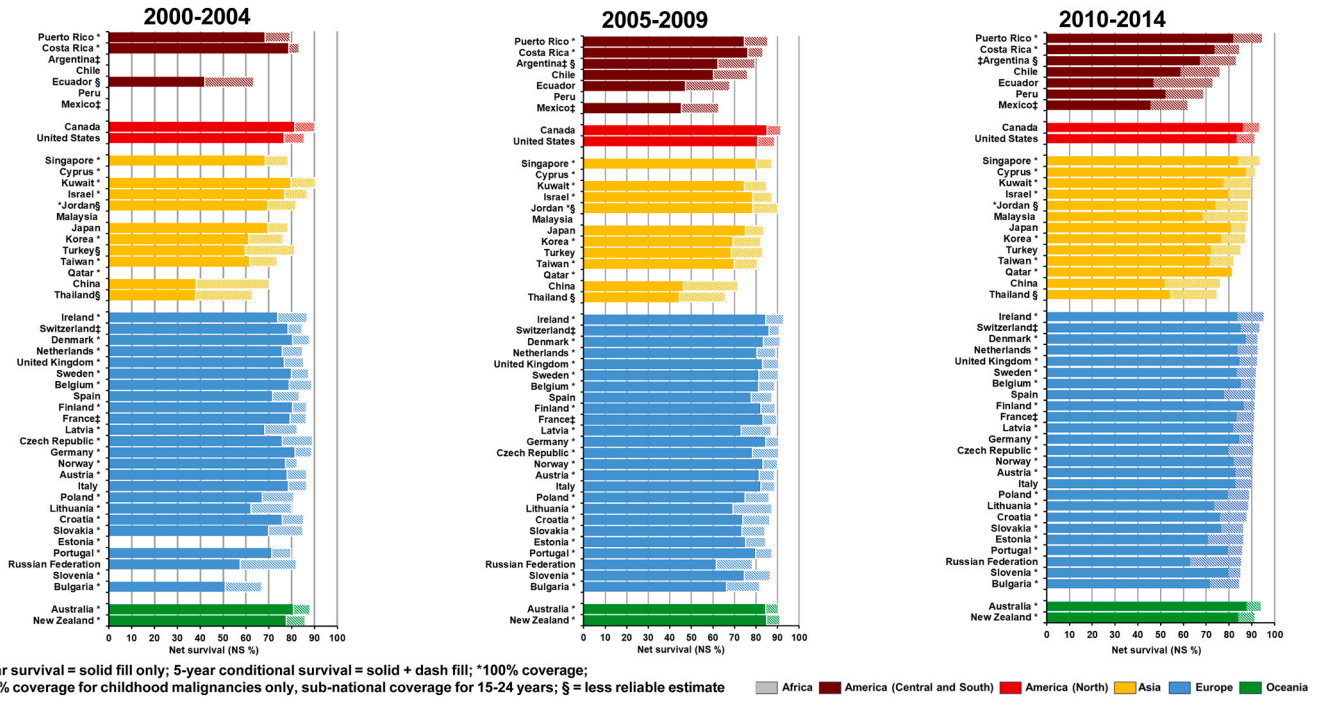

Fig. 1. Age-standardised five-year and five-year conditional net survival (NS, %) for children, adolescents and young adults (0–24 years) diagnosed with leukaemia, during 2000–2014; by continent and country. ‡ Data with 100 % coverage of the national population for childhood malignancies only, data for 15–24 years if available are provided from registries with sub-national coverage. * Data with 100 % coverage of the national population. § National estimate flagged as less reliable because the only available estimates are from a registry or registries in this category. Survival estimates for each country are ranked from highest to lowest within each continent and the ranking of countries for the 5-year conditional survival net estimates for patients diagnosed in 2010–2014 is also used for the 5-year net survival estimates. Only age-standardised estimates are reported, preference was given where standardised estimated were available for conditional estimates. Where data were available for more than one registry in a given country, the survival estimates are derived by pooling the data for that country but excluding data from registries for which the estimates are considered less reliable (see text).

(Supplementary Table 2, Supplementary Figure 1).

Over time, inequalities in survival by age at diagnosis were evident. The gap in five-year survival conditional to surviving one year, for all leukaemias combined, between high-income countries and low-income and middle-income countries persisted throughout the 15-year period (Fig. 3). By 2010–2014, five-year conditional survival for children was 90 % or higher in high-income countries. Survival for children in low-income and middle-income countries was catching up at 80 %, but the gap persisted. Survival for adolescents and young adults still lagged behind survival in children, and the gap was more evident in low- and middle- income countries (Fig. 3).

For patients diagnosed during 2000–2004, age-standardised ten-year net survival for all leukaemias combined ranged from 35 % in China to 81 % in Canada and Iceland (Supplementary Table 5, Supplementary Figure 2). It was at least 70 % in North America, Oceania and most European countries, but tended to be around 5 % lower in Asia. When restricting the estimate to patients who survived to the fifth anniversary after their diagnosis, the differences in survival between countries were smaller. Ten-year survival conditional on surviving five years after diagnosis was 90 % or higher in most countries.

The availability of data on whether or not a first course of systemic treatment was given was limited. Overall such data were available for 77,257 out of 164,563 (46.9 %) patients from 75 registries in 20 countries (Supplementary Table 6). Overall, the proportion of patients with systemic treatment information (i.e. treatment given or not given) varied from 36.9 % in Russian Federation to between 95 % and 100 % in 10 countries. No data on systemic treatment were submitted from registries in Africa or Oceania. The proportion of patients for whom no data on systemic treatment were available ranged from less than 2 % in Kuwait to greater than 60 % in Russian Federation. During the 15-year period, for 12 countries, Canada, United States, Japan, Kuwait, Ireland, Netherlands, Portugal, Slovenia, Slovakia, Spain, Switzerland and the United Kingdom, 80 % or more of patients had received systemic therapy within the first six months of diagnosis. The median days to the start of treatment overall was within a week, but this data was very limited and available for 12 out of 20 countries (Supplementary Table 6).

4. Discussion

Our study offers the largest world-wide population-based assessment of trends in survival up to ten years, conditional on surviving up to five years since diagnosis, as a proxy of the impact of treatment or remission of leukaemia during the first few years after diagnosis. Using population-based cancer registry data for 164,563 young patients (aged 0–24 years) diagnosed with leukaemia during 2000–2014, we examined five-year conditional survival for patients who had already survived one-year, and ten-year conditional survival for those who survived five years after diagnosis. One-year survival was generally high, reaching 90 % or more in most parts of Europe, Oceania and North America. Overall, survival varied at one year of follow-up after diagnosis and the gaps became more evident with increasing time since diagnosis.

For all leukaemias combined, during 2010–2014, for patients aged 0–24 years living in Europe, North America and Oceania, five-year conditional survival was generally 5 % higher than five-year survival from diagnosis and showed less regional variation, a finding consistent with other studies [22,23]. In Oceania, North America and parts of Asia, the gap in conditional survival between countries was narrower, highlighting the effect of treatment in the first year. The use of well-established treatment protocols in these regions means that patients are more likely to have access to optimal care. Collaborative efforts in Europe, North America and Oceania, through established cooperative trial groups such as the Children's Oncology Group, have

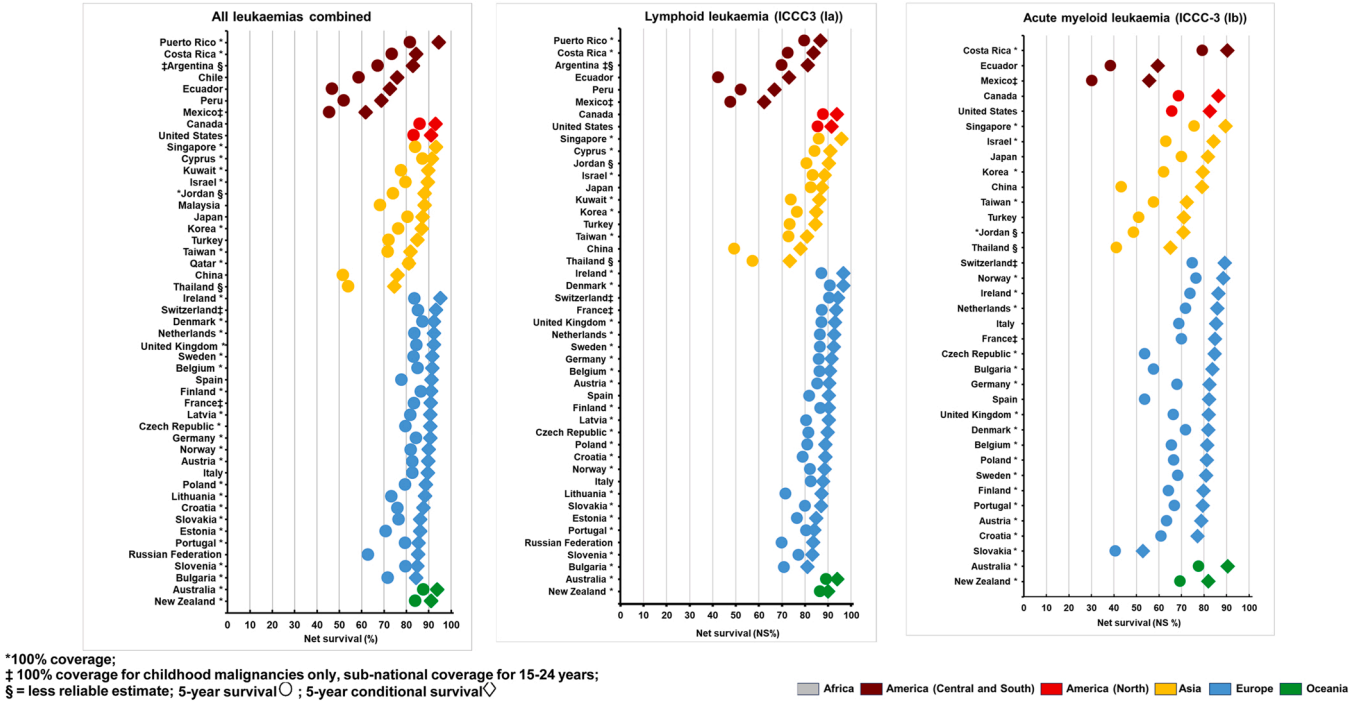

Fig. 2. Age-standardised 5-year net survival and 5-year conditional survival for children adolescents and young adults (0–24 years) diagnosed with leukaemia during 2010–2014; by country and morphology sub-group. ‡ Data with 100 % coverage of the national population for childhood malignancies only, data for 15–24 years if available are provided from registries with sub-national coverage. * Data with 100 % coverage of the national population. § National estimate flagged as less reliable because the only available estimates are from a registry or registries in this category. Survival estimates for each country are ranked from highest to lowest within each continent and the ranking of countries for the 5-year conditional survival net estimates for patients diagnosed in 2010–2014 is also used for the 5-year net survival estimates. Where data were available for more than one registry in a given country, the survival estimates are derived by pooling the data for that country but excluding data from registries for which the estimates are considered less reliable (see text).

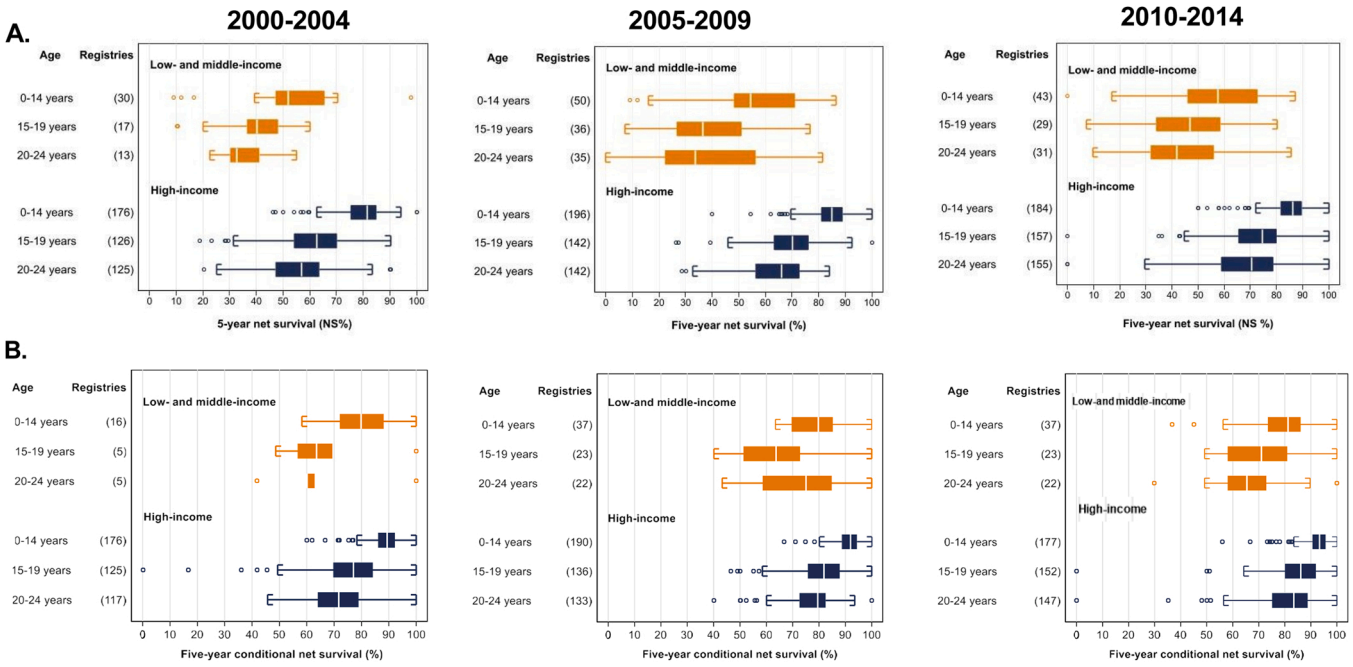

Fig. 3. Five-year (A) and five-year conditional net survival (NS %) (B) for all leukaemias combined, in patients aged (0–24 years) diagnosed during 2000–2014: World Bank income group and calendar period of diagnosis. The number of registries for which suitable estimates could be obtained are shown in parentheses. Each box plot shows the range of net survival estimates among all cancer registries for which suitable estimates could be obtained for patients diagnosed in each calendar period, in each age group. Survival estimates considered less reliable are not included. The vertical line inside each box represents the median survival estimate among all contributing registries (the central value in the range, or 50th centile). The box covers the inter-quartile range (IQR) between the lower and upper quartiles (25th and 75th centiles). Where there are only a few widely scattered estimates, the median might be close to the lower or upper quartile. The extreme limits of the box plot are 1·5 × IQR below the lower quartile and 1·5 × IQR above the upper quartile. Open circles indicate outlier values, outside this range.

led to improved outcomes especially for children. [4,24,25]. Furthermore, improvements over time are also due to better supportive care, and enhanced risk stratification strategies in addition to treatment intensity and optimization, including the employment of hematopoietic stem cell transplantation [26,27].

In addition, the availability of effective targeted therapies since the early 2000s, such as imatinib has contributed to better long-term prognosis [28,29]. Imatinib is a tyrosine kinase inhibitor, primarily used to treat specific types of leukaemia, such as chronic myeloid leukaemia (CML) [28], which accounts for about 3 % of childhood cancers and, to a lesser extent, certain cases of acute lymphoblastic leukaemia (ALL) with the Philadelphia chromosome. Nonetheless, the tight adherence to risk-adapted therapies [30] and the readiness to enrol most children with leukaemia in long-running series of clinical trials has also led to improved prognosis [31–34].

In Europe, the regional variation in five-year survival was smaller when restricted to patients who survived the first year after diagnosis. Greater increases were noted in parts of Eastern Europe (Bulgaria and Russian Federation). This could be due to the fact that countries in parts of Eastern Europe now participate in international clinical trials for childhood leukaemia [35]. Nevertheless, the continuing variation in survival could be driven by the fact that access to appropriate treatment, diagnostic or cancer management facilities is more limited than in the rest of the region.

In Central and South America and in parts of Asia, five-year survival was lower than in other world regions, and the differences in five-year conditional survival were less marked, showing a noticeable effect of surviving during the first year of diagnosis. This may reflect the fact that a considerable proportion of patients with advanced disease die during the first year and those who survive were diagnosed at less-advanced disease [36,37]. During 2010–2014, the absolute difference between five-year survival and five year survival among patients who survived the first year after diagnosis ranged from 10 % in Costa Rica to 25 % in Ecuador.

These variations highlight the heterogeneous nature of cancer management in young patients in Central and South America. For example, during 2010–2014 in Mexico, the absolute difference between five-year survival and five-year conditional survival was greater than 15 %, highlighting the potential impact of treatment during the first year. This difference in survival may be influenced by changes in government legislation in Mexico related to healthcare funding for young patients in the preceding years that improved access to appropriate treatment. In the mid-2000s, the Mexican government introduced legislation that provided financial support for patients without social security to ensure that young patients under the age of 18 would have access to appropriate care and management [4,38–40]. Furthermore, in 2006, the government began funding treatment for children and adolescents with acute lymphoid leukaemia, ensuring that all hospitals that managed young patients adhered to treatment protocols [38,41].

Likewise, for patients diagnosed with leukaemia in China during 2010–2014, five-year conditional survival was 25 % higher than five-year survival. This is probably influenced by better access to appropriate treatment, especially for children and adolescents, following changes in Chinese legislation to provide financial support for young people diagnosed with cancer [42–44]. By contrast, five-year conditional survival for some countries in Asia, such as Cyprus, Japan and Singapore, was approaching the level seen in Europe, North America and Oceania. In Japan, long-standing support since the early 70's through governmental subsidies for children and adolescents with cancer has led to improved outcomes overtime [8,9,45].

Nevertheless, survival in these regions continues to lag behind Europe, North America and Oceania, where most countries are well resourced. Several factors probably contributed to these gaps in survival, including delayed presentation with symptoms, poor nutritional status, inconsistent drug availability, abandonment of treatment, and a lack of appropriate supportive care and specialist treatment [46–48]. Most countries in low-resource settings adopt treatment guidelines based on the experience of well-resourced countries where these treatments are developed [46,47]. These guidelines may not be as appropriate, because they require supportive care capabilities that may not be readily available in low-resource settings. Lack of appropriate infrastructure can lead to excess deaths due to intensive treatment as well as high rates of treatment abandonment [47–49].

In the past few years, international collaborations have been established whereby institutions in well-resourced settings are paired with an institution in low-resourced settings. Several of such initiatives have been established in Latin America and Asian regions. [47,48] These collaborations aim to facilitate effective cancer-treatment programmes and improve outcomes for patients in these settings [47,48]. In the long-term, population-based survival trends will help assess the success of such initiative in improving outcomes for young people who live in these regions. Often, survival estimates derived from studies conducted in specialist treatment centres can be higher than those derived from population-based data especially in countries with limited resources that have the lowest survival [50,51]. This further emphasises the need for unselected population-based data to provide accurate indicators of the outcome for the entire patient population.

When considering the effect of age at diagnosis on survival, our findings also highlighted evident inequalities. Overall, children experienced better survival, both at time of diagnosis and after surviving the first year. Survival was approaching 90 % by 2010–2014 particularly in North America, Europe and Oceania. Children living in these world regions have benefited from decades of advances in treatment, establishment of designated specialised paediatric oncology centres, enrolment to ongoing clinical trials and standardised treatment protocols [4,24,25,32]. However, the same improvements were not achieved for the older patients aged 15–19 years and 20–24 years. When considering the effect of treatment in the first year, we noted that the gap in survival compared to children reduced by 10 %. Adolescents and young adults often experience delays in diagnosis or present late with more advanced symptoms than children [7,9]. Poorer outcomes in this age-range may be related to a lack of symptom awareness, poorer adherence to treatment or difficulties in health system navigation [52,53]. Furthermore, they often have restricted access to novel treatments due to limited number of clinical trials in this age range, as well as restricted access to optimal treatment strategies [5,9].

There is currently no consensus on the definition of the age range for adolescents and young adults diagnosed with cancer, with the upper limit approaching 39 years in some studies [53]. However, the more commonly used age range are defined as ages 15–24 years or 15–29 years at diagnosis [5,7,52]. For CONCORD-3, we defined adolescents and young adults as those aged 15–24 years at diagnosis, in line with the literature [7,52]. The heterogenous approaches to defining this patient group highlight the particular difficulties in health system navigation. Previous research has shown that adolescents and young adults who are treated under a paediatric protocol have better prognosis than those treated under adult protocols [8,25,54–56]. This approach is not widely adopted worldwide, leading to gaps in survival between countries. Closing the gap will require commitment to develop integrated models of care, targeted trials and age-appropriate treatment for this patient group [5,53]. Projects such as the Global Initiative for Childhood Cancer (GICC), are a step in the right direction but only include recommendations for patients aged 0–19 years [57].

World-wide, five-year conditional survival for patients diagnosed with acute myeloid leukaemia was lower than for lymphoid leukaemia. In 2010–2014, five-year conditional survival for patients with lymphoid leukaemia was approaching 90 % in most parts of Europe, North America and Oceania. On average, five-year conditional survival for patients with acute myeloid leukaemia ranged from 50 % to 80 %. For countries where five-year survival for acute myeloid leukaemia was lower, an increase in survival became more apparent when taking into account survival after the first year after diagnosis, consistent with other

findings [58]. Acute myeloid leukaemia is an aggressive sub-type of leukaemia and without treatment most patients die within weeks or months after diagnosis [58,59]. Access to optimal care is especially crucial for these patients. Due to sparse data for adolescents and young adults, with fewer patients still alive at one and five years since diagnosis, we could not estimate conditional survival for other morphology sub-types, especially by age. Nevertheless, our results are particularly relevant because they are derived from the largest set of analyses of population-based survival for leukaemia in young people.

For leukaemia, chemotherapy or some form of systemic therapy will often be the main form of treatment. The main goal is to induce remission, and for children this often involves intensive treatment within the first few months of therapy. Submission of data on the initial course of treatment was optional for CONCORD-3 because these data are not routinely collected by most population-based cancer registries. Where data were available, over 80 % of patients had received systemic therapy within six months of diagnosis in 12 countries: Canada, United States, Japan, Kuwait, Ireland, Netherlands, Portugal, Slovenia, Slovakia, Spain, Switzerland and the United Kingdom. It is worth noting that in countries with sub-regional coverage, data on treatment were often submitted by only a single registry. Furthermore, details of drug regimes, dose and duration are not captured adequately in population-based registries making any variation hard to interpret. Treatment data could be captured through efficient record linkage with clinical audit databases.

In conclusion, well-established therapeutic protocols for children with leukaemia have led to improved prognosis over the past few decades. In this study, we have offered an alternative approach to assessing the success of health care systems in managing leukaemia in young people. Conditional survival is a measure that enables an indirect assessment of the success of treatment during the first year(s) after diagnosis. After considering the impact of surviving up to five years since diagnosis, differences in 10-year survival were less marked, especially in countries where survival was low. This highlights the need to understand better what affects the outcomes of young patients in the initial year(s) after diagnosis. Children have benefited the most from national and international collaborative efforts to ensure streamlined treatment protocols, especially in countries that are well resourced. However, important inequities still exist between high-income and low- or middle-income countries. Efforts to extend this to settings with low resources and to adolescents and young adults are on-going. Assessment of these initiatives with data from population-based cancer registries will be crucial to determine the improvements in quality care in this age-group.

CRediT authorship contribution statement

Study design: CA, MPC and NS. Acquisition of statutory and ethical approvals: MPC and CA. Life tables construction: CA and MPC. Data quality controls: NS, CA, MPC. Formal analyses: NS. Writing—original draft: NS, CA, MPC. Review and editing: NS, CA, MPC, CS, RMG, CK, NSJ and JLB provided advice on methods and interpretation of results. All authors checked and contributed to writing the final report. All CONCORD Working Group members had access to the results of all steps of data preparation, quality control and analyses, and contributed to interpretation of the findings. Decision to submit: CA, MPC and NS. Funding acquisition: CA, MPC

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank Prof. Magdalena Bielska-Lasota for her thoughtful comments.

Appendix

*** CONCORD Working Group**

Africa—*Algeria*: S Bouzbid (Registre du Cancer d'Annaba); M Hamdi-Chérif* , L Kara (Registre du Cancer de Sétif); K Meguenni, D Regagba (Registre du Cancer Tlemcen); ***Mali*:** S Bayo, T Cheick Bougadari (Kankou Moussa University); ***Mauritius*:** SS Manraj (Mauritius National Cancer Registry); ***Morocco*:** K Bendahhou (Registre du Cancer du Grand Casablanca); ***Nigeria*:** A Fabowale, A Ladipo, OJ Ogunbiyi* (Ibadan Cancer Registry); ***South Africa*:** NIM Somdyala (Eastern Cape Province Cancer Registry)

America (Central and South)—*Argentina*: MA Chaplin, F Moreno (National Childhood Cancer Registry); GH Calabrano, SB Espinola (Chubut Cancer Registry); B Carballo Quintero, R Fita (Registro Provincial de Tumores de Córdoba); WD Laspada (Registro Provincial de Tumores de Mendoza); SG Ibañez (Population Registry of Cancer of the Province Tierra del Fuego); ***Brazil*:** CA Lima, D Palmeira Dias (Registro de Câncer de Base Populacional de Aracaju); W Ferreira Ramos Neto, F Lima Vazquez (Population-Based Cancer Registry - DRS V Barretos); PCF De Souza (Registro de Câncer de Base Populacional de Cuiabá); J Chaves, CA Laporte (Registro de Curitiba); MP Curado, JC Oliveira (Registro de Goiânia); CLA Veneziano, DB Veneziano (Registro de Câncer de Base Populacional de Jaú); ABM Almeida, MRDO Latorre (Registro de Câncer de São Paulo); R de Almeida Gil* (Instituto Nacional de Câncer - INCA); MS Rebelo, MO Santos (Instituto Nacional de Câncer, Rio de Janeiro); G Azevedo e Silva* (University of Rio de Janeiro); ***Chile*:** JC Galaz (Registro Poblacional de Cáncer Region de Antofagasta); M Aparicio Aravena, J Sanhueza Monsalve (Registro Poblacional de Cáncer de la Provincia de Biobio; Registro Poblacional de Cáncer Provincia de Concepción); DA Herrmann, S Vargas (Registro Poblacional Region de Los Rios); C Goić* (Magallanes, Chile); ***Colombia*:** CM Hormiga Sánchez, CJ Uribe (Registro Poblacional de Cáncer Area Metropolitana de Bucaramanga); P Collazos, AD Cortés Buelvas (Cali Cancer Registry); NE Arias-Ortiz, A Giraldo-Osorio (Registro Poblacional de Cáncer de Manizales); LM Bravo Goyes, HM Casas Cruz (Registro Poblacional de Cáncer del Municipio de Pasto); ***Costa Rica*:** S Delgado, M Ramirez (National Registry of Tumors, Costa Rica); ***Cuba*:** LM Fernández Garrote, YH Galán Alvarez (Registro Nacional de Cáncer de Cuba); ***Ecuador*:** NL Campoverde Arevalo, MJ Orbe Muñoz (Cuenca Tumor Registry Instituto del cancer SOLCA Cuenca); LE Jaramillo Feijoo, JJ Real Cotto (Guayaquil Cancer Registry); JM Castillo, A Gomez (Loja Cancer Registry); M Mendoza (Manabí Cancer Registry); W Tarupi (Quito Cancer Registry); ***France*:** B Bhakkan, J Deloumeaux (Registre des cancers de la Guadeloupe); C Joachim, J Macni (General Cancer Registry of Martinique); ***Mexico*:** R Carrillo, J Shalkow Klincovstein (Centro Nacional para la Salud de la Infancia y la Adolescencia); R Rivera Gomez (Registro Poblacional de Cancer Region Fronteriza Norte de Mexico Zona Tijuana); ***Peru*:** P Perez, E Poquioma (Lima Metropolitan Cancer Registry); ***Puerto Rico*:** CR Torres-Cintrón (Puerto Rico Central Cancer Registry); ***Uruguay*:** R Alonso, E Barrios (Registro Nacional de Cáncer)

America (North)—*Canada*: A Eckstrand, L Shack (Alberta Cancer Registry); J Simkin, RR Woods (British Columbia Cancer Registry); S Fukumura, D Turner* (Manitoba Cancer Registry/CancerCare Manitoba); E Kumar, B Zhang (New Brunswick Provincial Cancer Registry); JJ Dowden, GP Doyle (Newfoundland & Labrador Cancer Registry); N Saint-Jacques, G Walsh (Nova Scotia Cancer Registry); A Anam, P De (Ontario Cancer Registry); CA McClure, KA Phillips (Prince Edward Island Cancer Registry); C Bertrand, AV Ramanakumar (Registre Québécois du Cancer); L Davis, S Kozie (Saskatchewan Cancer Agency); ***USA*:** T Freeman, JT George (Alabama Statewide Cancer Registry); J

Cleaton (Alaska Cancer Registry); LM Collins, D Ramirez Aguilar (Arkansas Central Cancer Registry); L Almon (Metropolitan Atlanta Registry); S Kwong, C Morris (California State Cancer Registry); R Rycroft (Colorado Central Cancer Registry); L Gonsalves (Connecticut Tumor Registry); S Nagarajan (Delaware Cancer Registry); W Ross (Delaware Cancer Registry; Nebraska Cancer Registry Partner - Westat); J Ruterbusch, AG Schwartz (Metropolitan Detroit Cancer Surveillance System); DJ Lee, GM Levin (Florida Cancer Data System); R Bayakly (Georgia Cancer Registry); KC Ward (Georgia Cancer Registry; Metropolitan Atlanta Registry); SL Gomez, M McKinley (Greater Bay Area Cancer Registry); A Shrestha, S Zhang (Cancer Registry of Greater California); J Davis, BY Hernandez (Hawaii Tumor Registry); CJ Johnson, BM Morawski (Cancer Data Registry of Idaho); LP Ruppert (Indiana State Cancer Registry); S Bentler, ME Charlton (State Health Registry of Iowa); EB Durbin, B Huang (Kentucky Cancer Registry); L Liu (Los Angeles Cancer Surveillance Program); MC Hsieh, XC Wu (Louisiana Tumor Registry); C Bancroft (Maine Cancer Registry); TM Adamson, JH Hayes (Maryland Cancer Registry); ST Gershman, RC Knowlton (Massachusetts Cancer Registry); G Alverson (Michigan State Cancer Surveillance Program); J Desai, M Highsmith (Minnesota Cancer Reporting System); DB Rogers (Mississippi Cancer Registry); I Zachary (Missouri Cancer Registry and Research Center); D Lemons, HJ Zimmerman (Montana Central Tumor Registry); M Watson (Nebraska Cancer Registry); W Hammond, JR Rees (New Hampshire State Cancer Registry); LE Paddock, AM Stroup (New Jersey State Cancer Registry); C Key, C Wiggins (New Mexico Tumor Registry); TZ Insaf, B Qiao (New York State Cancer Registry); C Rao, F Simsek (North Carolina Central Cancer Registry); E Bunt, RM Slocumb (Ohio Cancer Incidence Surveillance System); M Carter (Oklahoma Central Cancer Registry); KG Aird, T Beran (Oregon State Cancer Registry); W Aldinger (Pennsylvania Cancer Registry); J Oh (Rhode Island Cancer Registry); TA Janes, SM Schwartz (Fred Hutchinson Cancer Center); SC Chiodini, DM Hurley (South Carolina Central Cancer Registry); MA Whiteside (Tennessee Cancer Registry); KL Musonda, SL Pruitt (Texas Cancer Registry); KA Herget, MM Millar (Utah Cancer Registry); M Flaherty, J Kachajian (Vermont Cancer Registry); MB Keitheri Cheteri, P Migliore Santiago (Washington State Cancer Registry); SE Blankenship, JL Conaway (West Virginia Cancer Registry); J Link Reeve, LC Swander (Wisconsin Cancer Reporting System); J Espinoza (Wyoming Cancer Surveillance Program); ME O′Neil, HK Weir* , R Wilson (Centers for Disease Control and Prevention); A Mariotto (National Cancer Institute); C Rodriguez-Galindo* (St. Jude Children's Research Hospital)

Asia—*China*: N Wang, L Yang (Beijing Cancer Registry); JS Chen, Y Zhou (Changle City Cancer Registry); YT He, GH Song (Cixian Cancer Registry); XP Gu (Dafeng County Center for Disease Control and Prevention); D Mei, HJ Mu (Dalian Centers for Disease Prevention and Control); HM Ge, TH Wu (Donghai County Center for Disease Prevention and Control); YY Li, DL Zhao (Feicheng County Cancer Registry); F Jin, JH Zhang (Ganyu Center for Disease Prevention and Control); FD Zhu (Guanyun Cancer Registry); Q Junhua, YL Yang (Haimen Cancer Registry); CX Jiang (Haining City Cancer Registry); W Biao, J Wang (Jianhu Cancer Registry); QL Li (Jiashan County Cancer Registry); H Yi, X Zhou (Jintan Cancer Registry); J Dong, W Li (Lianyungang Center for Disease Prevention and Control); FX Fu, SZ Liu (Linzhou Cancer Registry); JG Chen, J Zhu (Qidong County Cancer Registry); YH Li, YQ Lu (Sihui Cancer Registry); M Fan, SQ Huang (Taixing Cancer Registry); GP Guo, H Zhaolai (Cancer Institute of Yangzhong City); K Wei (Zhongshan City Cancer Registry); WQ Chen* , W Wei* , H Zeng (The National Cancer Center); ***Cyprus*:** AV Demetriou (Cyprus Cancer Registry); ***Hong Kong*:** WK Mang, KC Ngan (Hong Kong Cancer Registry); ***India*:** AC Kataki, M Krishnatreya (Guwahati Cancer Registry); PA Jayalekshmi, P Sebastian (Karunagappally Cancer Registry); P Mathur* (National Centre for Disease Informatics and Research, Indian Council of Medical Research); ***Iran*:** R Malekzadeh, G Roshandel (Golestan Population-based Cancer Registry); ***Israel*:** L Keinan-Boker, BG Silverman (Israel National Cancer Registry); ***Japan*:** H Ito, Y Koyanagi (Aichi Cancer Registry); M Sato, F Tobori (Akita Prefectural Cancer Registry); N Teramoto, N Yamashita (Ehime Prefectural Cancer Registry); M Hattori, Y Kaizaki (Fukui Cancer Registry); F Moki (Gunma Prefectural Cancer Registry); H Sugiyama, M Utada (Hiroshima Prefecture Cancer Registry); M Nishimura, K Yoshida (Hyogo Prefectural Cancer Registry); K Kurosawa, Y Nemoto (Ibaraki Prefectural Cancer Registry); H Narimatsu, K Watanabe (Kanagawa Cancer Registry); S Kanemura (Miyagi Prefectural Cancer Registry); M Kobayashi, M Naito (Niigata Prefecture Cancer Registry); I Miyashiro, K Nakata (Osaka Cancer Registry); D Mori, M Yoshitake (Saga Prefectural Cancer Registry); S Fujita, I Oki (Tochigi Prefectural Cancer Registry); N Fukushima, A Shibata (Yamagata Prefectural Cancer Registry); K Iwasa, C Ono (Yamanashi Cancer Registry); T Matsuda* (National Cancer Center); ***Jordan*:** O Nimri (Jordan National Cancer Registry); ***Korea*:** KW Jung, YJ Won (Korea Central Cancer Registry); ***Kuwait*:** E Alawadhi, A Elbasmi (Kuwait Cancer Registry); ***Malaysia*:** A Ab Manan (Malaysia National Cancer Registry); F Adam (Penang Cancer Registry); ***Mongolia*:** E Nansalmaa, U Tudev (Cancer Registry of Mongolia); C Ochir (Mongolian National University of Medical Sciences); ***Qatar*:** AM Al Khater, MM El Mistiri (Qatar Cancer Registry); ***Singapore*:** M Cai, LL Foo (Singapore Cancer Registry); ***Taiwan*:** CJ Chiang, WC Lee (Taiwan Cancer Registry); ***Thailand*:** R Buasom, S Sangrajrang (Bangkok Cancer Registry); C Santong (Khon Kaen Cancer Registry); K Daoprasert, D Pongnikorn (Lampang Cancer Registry; Lamphun Cancer Registry); A Leklob, S Sangkitipaiboon (Lopburi Cancer Registry); SL Geater, H Sriplung (Songkhla Cancer Registry); ***Turkey*:** O Ceylan, I Kög (Ankara Cancer Registry); G Aksoy, H Karakilinç (Antalya Cancer Registry); T Köse (Bursa Cancer Registry); T Gurbuz (Edirne Cancer Registry); FE Karaşahin, D Turhan (Erzurum Cancer Registry Center); N Karagöz, B Kurnali (Eskişehir Cancer Registry); S Eser, CI Yakut (Izmir Cancer Registry); M Altinisik, Y Cavusoglu (Samsun Cancer Registry); A Türkköylü, N Üçüncü (Trabzon Cancer Registry)

Europe—*Austria*: M Hackl (Austrian National Cancer Registry); ***Belarus*:** M Borisevich, T Savich (Belarus Childhood Cancer Subregistry); ***Belgium*:** K Henau, L Van Eycken (Belgian Cancer Registry); ***Bulgaria*:** TY Atanasov, Z Valerianova (Bulgarian National Cancer Registry); ***Croatia*:** P Ivanko, M Šekerija (Croatian National Cancer Registry); ***Czech Republic*:** J Mužík, M Zvolský (The Institute of Health Information and Statistics of the Czech Republic); ***Denmark*:** SM Kønig, L Steinrud Mørch, H Storm* (Danish Cancer Society); ***Estonia*:** K Innos, M Mägi (Estonian Cancer Registry, National Institute for Health Development); ***Finland*:** S Heinävaara, K Seppä (Finnish Cancer Registry); ***France*:** J Jégu, M Velten (Bas-Rhin General Cancer Registry); E Cornet, X Troussard (Registre Régional des Hémopathies Malignes de Basse Normandie); AM Bouvier (Registre Bourguignon des Cancers Digestifs); N Vigneron (Calvados general tumour registry); V Bouvier, G Launoy (Registre des Tumeurs Digestives du Calvados); S Dabakuyo Yonli, ML Poillot (Breast and Gynecologic Cancer Registry of Côte d'Or France); A Guilloteau, M Maynadié (Hémopathies Malignes de Côte d′Or); L Vaconnet, AS Woronoff (Doubs General Cancer Registry); M Daoulas, M Robaszkiewicz (Finistère Cancer Registry); J Clavel, C Poulalhon (French National Registry of Childhood Hematopoietic Malignancies); E Desandes, B Lacour (National Registry of Childhood Solid Tumors); I Baldi (Gironde Registry of Primary Central Nervous System Tumors); B Amadeo, G Coureau (General Cancer Registry of Gironde Department); A Monnereau, S Orazio (Registre des Hémopathies Malignes de la Gironde); M Audoin, TC D′Almeida (Registre Général des Cancers de Haute-Vienne); S Boyer, K Hammas (Haut-Rhin Cancer Registry); B Trétarre (Registre des Tumeurs de l′Hérault); P Delafosse, F Poncet (Isère Cancer Registry); S Plouvier (Registre Général des Cancers de Lille et de sa Region); A Cowppli-Bony (Loire-Atlantique-Vendée Cancer Registry); F Molinié (Loire-Atlantique-Vendée Cancer Registry; French Network of Cancer Registries (FRANCIM)); S Bara (Manche Cancer Registry); O Ganry, B Lapôtre-Ledoux (Registre du Cancer de la Somme); L Daubisse-Marliac, S Lamy (Tarn Cancer Registry); N Bossard, Z Uhry (Hospices Civils de Lyon); ***Germany*:** M Pflüger, N Stoletzki (Clinical-epidemiological Cancer Registry Brandenburg-Berlin); A Eberle, S Luttmann

(Bremen Cancer Registry); F Peters, A Schultz (Hamburg Cancer Registry); J Kieschke, E Sirri (Epidemiological Cancer Registry of Lower Saxony); R Stabenow, H Wilsdorf-Köhler (Common Cancer Registry of the Federal States); C Justenhoven, F Reinwald (Rhineland Palatinate Cancer Registry); B Holleczek (Saarland Cancer Registry); A Katalinic, R Pritzkuleit (Schleswig-Holstein Cancer Registry); ***Gibraltar*****:** RA Asquez, V Kumar (Gibraltar Cancer Registry); ***Greece*****:** E Petridou (Nationwide Registry for Childhood Haematological Malignancies and Solid Tumors); ***Iceland*****:** EJ Ólafsdóttir (Icelandic Cancer Registry, Icelandic Cancer Society); H Birgisson (Icelandic Cancer Society); ***Ireland*****:** DE Murray, MT Redaniel (National Cancer Registry Ireland); H Sundseth* (European Institute of Women's Health); M Harney* (University of Limerick); ***Italy*****:** E Coviello, F Cuccaro (Registro Tumori Puglia – Sezione ASL BT); R Galasso (Registro Tumori di Basilicata); G Sampietro (Registro Tumori di Bergamo); M Magoni (Registro Tumori Dell'ASL Di Brescia); A Ardizzone (Registro Tumori Brindisi); M Merola, MT Pesce (Caserta Cancer Registry); RM Ragusa, A Torrisi (Integrated Cancer Registry of Catania-Messina-Enna); AM Lavecchia, A Sutera Sardo (Registro Tumori Catanzaro); G Gola (Registro Tumori della Provincia di Como); P Ballotari, E Giacomazzi (Registro Tumori Cremona; Registro Tumori Mantova); S Ferretti (Registro Tumori della Provincia di Ferrara); L Dal Maso, D Serraino (Registro Tumori del Friuli Venezia Giulia); C Casella, A Puppo (Registro Tumori Regione Liguria); F Pannozzo (Registro Tumori della Provincia di Latina); A Melcarne, F Quarta (Registro Tumori Della Provincia Di Lecce Sezione RTP); F Gervasi, AG Russo (Registro Tumori Milano); G Carrozzi, C Cirilli (Registro Tumori della Provincia di Modena); L Cavalieri d'Oro, M Rognoni (Registro Tumori di Monza e Brianza); M Fusco, MF Vitale (Registro Tumori della ASL Napoli 3 Sud); M Usala (Nuoro Cancer Registry); R Cusimano, W Mazzucco (Registro Tumori di Palermo e Provincia); M Michiara, P Sgargi (Registro Tumori della Provincia di Parma); F Manzoni (Cancer Registry of the province of Pavia); G Chiaranda, P Seghini (Registro Tumori Piacenza); MM Maule (Piedmont Childhood Cancer Registry); G Cascone, E Spata (Ragusa and Caltanissetta Cancer Registry); P Mancuso, L Mangone (Registro Tumori Reggio Emilia); T Cassetti, R Sassatelli (Pancreas Tumor Registry of Reggio Emilia Province); F Falcini, R Vattiato (Registro Tumori della Romagna); AL Caiazzo, R Cavallo (Registro Tumori Salerno); D Piras (Registro Tumori Nord Sardegna); F Bella, A Madeddu (Registro Tumori Siracusa); AC Fanetti, S Maspero (Registro Tumori della Provincia di Sondrio); M Mian, F Vittadello (South Tyrol Cancer Registry (as a part of the Innovation, Research and Teaching Service of the Azienda Sanitaria dell'Alto Adige)); S Carone, A Mincuzzi (Registro Tumori Taranto); G Candela, T Scuderi (Registro Tumori Trapani); MA Gentilini, W Mantovani (Trento Cancer Registry); L Richiardi (Piedmont Cancer Registry); E Migliore (Piedmont Cancer Registry; Piedmont Childhood Cancer Registry); A Caldarella, T Intrieri (Registro Tumori della Regione Toscana); F Bianconi (Registro Tumori Umbro di Popolazione); P Contiero, G Tagliabue (Registro Tumori Lombardia, Provincia di Varese); M Sbaraglia, M Zorzi (Veneto Cancer Registry); S Beggiato, A Brustolin (Registro Tumori Della Provincia Di Viterbo); G Gatta (Fondazione IRCCS Istituto Nazionale dei Tumori); M Vicentini (Italian Association of Cancer Registries (AIRTUM)); R De Angelis (National Centre for Epidemiology); F Stracci (Italian Association of Cancer Registries (AIRTUM); Registro Tumori Umbro di Popolazione); ***Latvia*****:** Z Baltane, A Maurina (Latvian Cancer Registry); ***Liechtenstein*****:** M Blum, M Mousavi (Liechtenstein); ***Lithuania*****:** G Smailyte, L Steponaviciene (Lithuanian Cancer Registry); ***Malta*****:** MJ Azzopardi, N Calleja (Malta National Cancer Registry); ***Netherlands*****:** S Siesling, O Visser (Netherlands Cancer Registry, IKNL); ***Norway*****:** TB Johannesen, S Larønningen (Cancer Registry of Norway, Norwegian Institute of Public Health, Oslo, Norway); ***Poland*****:** M Trojanowski (Wielkopolski Rejestr Nowotworów); P Macek (Świętokrzyski Rejestr Nowotworów); T Mierzwa (Kujawsko-Pomorski Rejestr Nowotworów); A Rosińska (Łódzki Rejestr Nowotworów); K Kępska (Dolnośląski Rejestr Nowotworów); J Niewęgłowska (Lubelski Rejestr Nowotworów); K Barna (Lubuski Rejestr Nowotworów); U Sulkowska (Mazowiecki Rejestr Nowotworów); D Owsiak (Opolski Rejestr Nowotworów); E Garbowska (Podlaski Rejestr Nowotworów); M Meina (Pomorski Rejestr Nowotworów); M Motnyk (Śląski Rejestr Nowotworów); A Patro (Podkarparcki Rejestr Nowotworów); A Gos (Warmińsko-Mazurski Rejestr Nowotworów); K Sikorska (Zachodniopomorski Rejestr Nowotworów); JA Didkowska, U Wojciechowska (Polish National Cancer Registry); ***Portugal*****:** J Macedo (Azores Cancer Registry); G Forjaz de Lacerda (Westat); B Carrito, A Pais (Registo Oncológico Regional do Centro); MJ Bento, AC Rodrigues (Registo Oncológico Regional do Norte); A Lourenço, A Mayer-da-Silva (Registo Oncólogico Regional do Sul); ***Romania*****:** D Coza, AI Todescu (Cancer Institute I. Chiricuta); ***Russia*****:** MY Valkov (Arkhangelsk Regional Cancer Registry); L Gusenkova, O Lazarevich (Population Cancer Registry of the Republic of Karelia); O Prudnikova, DM Vjushkov (Omsk Regional Cancer Registry); A Egorova, A Orlov (Samara Cancer Regional Registry); LV Pikalova, LD Zhuikova (Population-Based Cancer Registry of Tomsk); ***Slovakia*****:** J Adamcik, C Safaei Diba (National Cancer Registry of Slovakia); ***Slovenia*****:** V Zadnik, T Žagar (Slovenian Cancer Registry); A Peterle* (Ljubljana, Slovenia); ***Spain*****:** M De-La-Cruz, A Lopez-de-Munain (Basque Country Cancer Registry); M Garrido (Canary Islands Cancer Registry); RJ Chillarón, AIM Navarro (Registro de Cáncer de Cuenca); R Marcos-Gragera, J Trallero (Girona Cancer Registry); D Redondo-Sanchez, MJ Sánchez Perez (Granada Cancer Registry); P Franch Sureda, M Ramos Montserrat (Mallorca Cancer Registry); MD Chirlaque López, A Sánchez Gil (Murcia Cancer Registry); E Ardanaz, M Guevara (Registro de Cáncer de Navarra, CIBERESP); A Cañete-Nieto, R Peris-Bonet (Spanish Registry of Childhood Tumours (RETI-SEHOP)); M Carulla, J Galceran (Tarragona Cancer Registry); F Almela, C Sabater (Comunitat Valenciana Childhood Cancer Registry); ***Sweden*****:** D Pettersson (Swedish Cancer Registry); P Dickman* (Karolinska Institutet, Stockholm); ***Switzerland*****:** K Staehelin, B Struchen (Basel Cancer Registry); M Blum, SM Mousavi (East Switzerland Cancer Registry); Y Bergeron, BW A van der Linden (Registre Fribourgeois des Tumeurs); E Rapiti, R Schaffar (Geneva Cancer Registry); R Von Moos (Cancer Registry Graubünden-Glarus); JL Bulliard, M Maspoli-Conconi (Registre Neuchâtelois et Jurassien des Tumeurs); CE Kuehni, G Sommer (Childhood Cancer Registry); A Bordoni, L Ortelli (Registro Tumori Canton Ticino); A Chiolero, I Konzelmann (Registre Valaisan des Tumeurs); S Rohrmann, M Wanner (Cancer Registry Zürich and Zug); F Cavalli* (Institute of Oncology Research (IOR)); ***United Kingdom*****:** J Broggio, S Stevens, C Stiller* (National Cancer Registration and Analysis Service England); D Bennett, D Fitzpatrick (Northern Ireland Cancer Registry); DS Morrison, G Stanner (Scottish Cancer Registry/Public Health Scotland); DW Huws, S Smits (Welsh Cancer Intelligence & Surveillance Unit); M Grayson* (Belfast, UK); H Rawcliffe* (Lancashire, UK); C Allemani* , MP Coleman* , V Di Carlo, F Girardi, M Matz, P Minicozzi, N Sanz, N Ssenyonga (London School of Hygiene & Tropical Medicine); R Stephens* (Patient Advocate, Stevenage)

Oceania—*Australia***:** E Chalker, M Smith (Australian Capital Territory Cancer Registry); J Gugusheff, H You (NSW Cancer Registry); R Boyd, S Dugdale (Northern Territory of Australia Cancer Registry); J Moore, S Philpot (Queensland Cancer Registry); R Pfeiffer, H Thomas (South Australian Cancer Registry); J Roydhouse, B Silva Ragaini (Tasmanian Cancer Registry); SM Evans, L Te Marvelde (Victorian Cancer Registry); H Cakan, K Handley (Western Australian Cancer Registry); J Aitken* (Cancer Council Queensland); ***New Zealand*****:** C Fowler, C Lewis (New Zealand Cancer Registry)

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ejca.2025.115445.

References

[1] Alvarez EM, Force LM, Xu R. GBD 2019 Adolescent Young Adult Cancer Collaborators. The global burden of adolescent and young adult cancer in 2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Oncol 2022;34:27–52.

[2] Steliarova-Foucher E, Colombet M, Ries LAG, et al. International incidence of childhood cancer, 2001-10: a population-based registry study. Lancet Oncol 2017; 18:719–31.

[3] Stiller CA. Global burden of childhood cancer: growing, but controllable. Lancet Oncol 2019;20:1184–5.

[4] Rodriguez-Galindo C, Friedrich P, Alcasabas P, et al. Toward the cure of all children with cancer through collaborative efforts: pediatric oncology as a global challenge. J Clin Oncol 2015;33:3065–73.

[5] Ssenyonga N, Stiller C, Nakata K, et al. Worldwide trends in population-based survival for children, adolescents, and young adults diagnosed with leukaemia, by subtype, during 2000–14 (CONCORD-3): analysis of individual data from 258 cancer registries in 61 countries. Lancet Child Adolesc Health 2022;6:409–31.

[6] Trama A, Bernasconi A, McCabe MG, et al. Is the cancer survival improvement in European and American adolescent and young adults still lagging behind that in children? Pedia Blood Cancer 2019;66:e27407.

[7] Bleyer A, Ferrari A, Whelan J, Barr RD. Global assessment of cancer incidence and survival in adolescents and young adults. Pedia Blood Cancer 2017:e26497. **00**.

[8] Nakata K, Okawa S, Fuji S, et al. Trends in survival of leukemia among children, adolescents, and young adults: a population-based study in Osaka, Japan. Cancer Sci 2021;112(3):1150–60.

[9] Nakata-Yamada K, Inoue M, Ioka A, et al. Comparison of survival of adolescents and young adults with hematologic malignancies in Osaka, Japan. Leuk Lymphoma 2016;57(6):1342–8.

[10] Coleman MP. Cancer survival: global surveillance will stimulate health policy and improve equity. Lancet 2014;383:564–73.

[11] Allemani C, Matsuda T, Di Carlo V, et al. Global surveillance of trends in cancer survival 2000–14 (CONCORD-3): analysis of individual records for 37,513,025 patients diagnosed with one of 18 cancers from 322 population-based registries in 71 countries. Lancet 2018;391:1023–75.

[12] Fritz AG, Percy C, Jack A, et al. International Classification of Diseases for Oncology (ICD-O). 3rd ed. Geneva: World Health Organisation; 2000 (editors).

[13] Fritz AG, Percy C, Jack A, et al. International Classification of Diseases for Oncology (ICD-O). First revision of 3rd ed (editors). Geneva: World Health Organisation; 2013.

[14] Steliarova-Foucher ECM, Ries LAG, Hesseling P, Moreno F, Shin HY, Stiller CA. International Incidence of Childhood Cancer, Volume III (electronic version). Lyon, France: International Agency for Research on Cancer; 2017.

[15] Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. International Classification of Childhood Cancer, third edition. Cancer 2005;103:1457–67.

[16] Estève J, Benhamou E, Raymond L. Statistical methods in cancer research, volume IV. Descriptive epidemiology. (IARC Scientific Publications No. 128). Lyon: International Agency for Research on Cancer; 1994.

[17] Brenner H, Gefeller O. An alternative approach to monitoring cancer patient survival. Cancer 1996;78:2004–10.

[18] Spika D, Bannon F, Bonaventure A, et al. Life tables for global surveillance of cancer survival (the CONCORD programme): data sources and methods. BMC Cancer 2017;17:159–73.

[19] Perme Pohar, Stare M, Estève J. J. On estimation in relative survival. Biometrics 2012;68:113–20.

[20] Clerc-Urmès I, Grzebyk M, Hédelin G. Net survival estimation with stns. Stata J 2014;14:87–102.

[21] Fantom NS Umar. The World Bank's Classification of Countries by Income. In: 7528. © PRWPN, editor. Washington, DC: World Bank; 2016.

[22] Youlden DB, Hallahan PD, Valery AR, Green PC, Aitken AC. JF. Conditional survival estimates for childhood cancer in Australia, 2002-2011: a population-based study. Cancer Epidemiol 2015;39:394–400.

[23] Walsh PM, Byrne J, Capra M, Comber H. Childhood cancer survival in Ireland: temporal, regional and deprivation-related patterns. Eur J Cancer 2011;47(12): 1852–62.

[24] Pui CH, Yang JJ, Hunger SP, et al. Childhood acute lymphoblastic leukemia: progress through collaboration. J Clin Oncol 2015;33:2938–48.

[25] Hunger SP, Lu X, Devidas M, et al. Improved survival for children and adolescents with acute lymphoblastic leukemia between 1990 and 2005: a report from the children's oncology group. J Clin Oncol 2012;30(14):1663–9.

[26] Gibson B.E.S., Sauer M.G., Amrolia P. Acute Myeloid Leukemia in Children. In: Carreras E, Dufour C, Mohty M, Kröger N, eds. The EBMT Handbook: Hematopoietic Stem Cell Transplantation and Cellular Therapies. Cham (CH): Springer Copyright 2019, EBMT and the Author(s). 2019: 523-30.

[27] Egan G, Chopra Y, Mourad S, Chiang KY, Hitzler J. Treatment of acute myeloid leukemia in children: a practical perspective. Pedia Blood Cancer 2021;68(7): e28979.

[28] Drozdov D, Bonaventure A, Nakata K, Suttorp M, Belot A. Temporal trends in the proportion of "cure" in children, adolescents, and young adults diagnosed with chronic myeloid leukemia in England: a population-based study. Pedia Blood Cancer 2018;65(12):e27422.

[29] Sant M, Minicozzi P, Mounier M, et al. Survival for haematological malignancies in Europe between 1997 and 2008 by region and age: results of EUROCARE-5, a population-based study. Lancet Oncol 2014;15:931–42.

[30] Bonaventure A, Harewood R, Stiller CA, et al. Worldwide comparison of survival from childhood leukaemia for 1995–2009, by subtype, age, and sex (CONCORD-2): a population-based study of individual data for 89 828 children from 198 registries in 53 countries. Lancet Haematol 2017;4:e202–17.

[31] Bartram J, Veys P, Vora A. Improvements in outcome of childhood acute lymphoblastic leukaemia (ALL) in the UK - a success story of modern medicine through successive UKALL trials and international collaboration. Br J Haematol 2020;191(4):562–7.

[32] Stiller CA, Kroll ME, Pritchard-Jones K. Population survival from childhood cancer in Britain during 1978-2005 by eras of entry to clinical trials. Ann Oncol 2012;23 (9):2464.

[33] Rossig C, Juergens H, Schrappe M, et al. Effective childhood cancer treatment: the impact of large scale clinical trials in Germany and Austria. Pedia Blood Cancer 2013;60(10):1574–81.

[34] Pritchard-Jones K, Pieters R, Reaman GH, et al. Sustaining innovation and improvement in the treatment of childhood cancer: lessons from high-income countries. Lancet Oncol 2013;14:e95–103.

[35] Campbell M, Kiss C, Zimmermann M, et al. Childhood acute lymphoblastic leukemia: results of the randomized acute lymphoblastic leukemia intercontinental-berlin-frankfurt-münster 2009 Trial. J Clin Oncol 2023;41(19): 3499–511.

[36] Sant M, Allemani C, Santaquilani M, et al. EUROCARE-4. Survival of cancer patients diagnosed in 1995-1999: results and commentary. Eur J Cancer 2009;45(. 6):931–91.

[37] Berrino F, De Angelis R, Sant M, et al. 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.

[38] Pérez-Cuevas R, Doubova SV, Zapata-Tarres M, et al. Scaling up cancer care for children without medical insurance in developing countries: the case of Mexico. Pedia Blood Cancer 2013;60:196–203.

[39] Atun R, Bhakta N, Denburg A, et al. Sustainable care for children with cancer: a Lancet Oncology Commission. Lancet Oncol 2020;21:185–224.

[40] Vasquez L, Fuentes-Alabi S, Benitez-Majano S, et al. Collaboration for success: the global initiative for childhood cancer in latin America. Rev Panam Salud Publica 2023;47:e144.

[41] Federacion D.Odl. Reglamento de la Ley General de Salud en materia de protección social en salud. Mexico; 2004.

[42] Zhou QH Dan, Lu Jun, Zheng Defei, Ashwani Neetica, Hu Shaoyan. Pediatric medical care system in China has significantly reduced abandonment of acute lymphoblastic leukemia treatment. J Pedia Hematol Oncol 2015;37:181–4.

[43] Zeng H, Chen W, Zheng R, et al. Changing cancer survival in China during 2003-15: a pooled analysis of 17 population-based cancer registries. Lancet Glob Health 2018;6(5):e555–67.

[44] Zeng H, Zheng R, Guo Y, et al. Cancer survival in China, 2003–2005: a population-based study. Int J Cancer 2014;136:1921–30.

[45] Gatta G, Botta L, Rossi S, et al. Childhood cancer survival in Europe 1999–2007: results of EUROCARE-5—a population-based study. Lancet Oncol 2014;15:35–47.

[46] Arora RS, Eden T, Pizer B. The problem of treatment abandonment in children from developing countries with cancer. Pedia Cancer 2007;49(7):941–6.

[47] Yeoh AE, Tan D, Li CK, et al. Management of adult and paediatric acute lymphoblastic leukaemia in Asia: resource-stratified guidelines from the Asian Oncology Summit 2013. Lancet Oncol 2013;14(12):e508–23.

[48] Hunger SP, Sung L, Howard SC. Treatment strategies and regimens of graduated intensity for childhood acute lymphoblastic leukemia in low-income countries: A proposal. Pedia Blood Cancer 2009;52(5):559–65.

[49] Gupta S, Yeh S, Martiniuk A, et al. The magnitude and predictors of abandonment of therapy in paediatric acute leukaemia in middle-income countries: a systematic review and meta-analysis. Eur J Cancer 2013;49:2555–64.

[50] Duffy C, Graetz DE, Lopez AMZ, et al. Retrospective analysis of outcomes for pediatric acute lymphoblastic leukemia in South American centers. Front Oncol 2023;13:1254233.

[51] Surapolchai P, Anurathapan U, Sermcheep A, et al. Long-term outcomes of modified st jude children's research hospital total therapy XIIIB and XV protocols for thai children with acute lymphoblastic leukemia. Clin Lymphoma Myeloma Leuk 2019;19(8):497–505.

[52] Gatta G, Zigon G, Capocaccia R, et al. Survival of European children and young adults with cancer diagnosed 1995-2002. Eur J Cancer 2009;45(6):992–1005.

[53] Trama A, Botta L, Foschi R, et al. Survival of European adolescents and young adults diagnosed with cancer in 2000–07: population-based data from EUROCARE-5. Lancet Oncol 2016;17:896–906.

[54] Gatta G, Capocaccia R, De Angelis R, Stiller C, Coebergh JW. EUROCARE Working Group. Cancer survival in European adolescents and young adults. Eur J Cancer 2003;39:2600–10.

[55] Bleyer A, Barr R, Hayes-Lattin B, et al. The distinctive biology of cancer in adolescents and young adults. Nat Rev Cancer 2008;8(4):288–98.

[56] Siegel SE, Stock W, Johnson RH, et al. Pediatric-inspired treatment regimens for adolescents and young adults with philadelphia chromosome-negative acute lymphoblastic leukemia: a review. JAMA Oncol 2018;4(5):725–34.

[57] World Health Organisation. WHO Global Initiative for Childhood Cancer: an overview. Geneva: WHO; 2018.

[58] Kaul S, Kirchhoff AC, Boucher KM, Dietz AC. Conditional survival for pediatric and adolescent patients with cancer: Implications for survivorship care. Cancer Epidemiol 2015;39(6):1071–7.

[59] Abrahão R, Keogh RH, Lichtensztajn DY, et al. Predictors of early death and survival among children, adolescents and young adults with acute myeloid leukaemia in California, 1988-2011: a population-based study. Br J Haematol 2016;173:292–302.