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Cancer incidence and survival in European adolescents (1978–1997). Report from the Automated Childhood Cancer Information System project

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ABSTRACT

Data on 15,399 adolescents diagnosed with cancer at age 15–19 years during 1978–1997 in Europe were extracted from the database of the Automated Childhood Cancer Information System (ACCIS). Total incidence in Europe as a whole was 186 per million in 1988–1997. Incidence among males was 1.2 times that among females. Lymphomas had the highest incidence of any diagnostic group, 46 per million, followed by epithelial tumours, 41 per million; central nervous system (CNS) tumours, 24; germ cell and gonadal tumours, 23; leukaemias, 23; bone tumours, 14; and soft tissue sarcomas, 13 per million. Total incidence varied widely between regions, from 169 per million in the East to 210 per million in the North, but lymphomas were the most frequent diagnostic group in all regions. Cancer incidence among adolescents increased significantly at a rate of 2% per year during 1978–1997. Five-year survival for all cancers combined in 1988–1997 was 73% in Europe as a whole. Survival was highest in the North, 78%, and lowest in the East, 57%. Five-year survival was generally comparable with that in the Surveillance, Epidemiology, and End Results (SEER) registries of the United States of America (USA), but for Ewing's sarcoma it was below 45% in all European regions compared with 56% in the USA. Survival increased significantly during 1978–1997 for all cancers combined and for all diagnostic groups with sufficient registrations for analysis.

1. Introduction

The international variations in the incidence of cancer in children are relatively well documented.[1] There has also been detailed exploration of survival rates among children in Europe.[2–4] There is considerably less published information on cancer incidence and survival among European adolescents.[5,6]

In Europe, less than 0.3% of all cancer cases occur in adolescents aged 15–19 years.[7] The pattern of tumour types

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occurring most commonly in this age group is distinctive, including some typical childhood tumours and others that occur mostly in adults. The most frequent tumour types are lymphomas, carcinomas, germ cell tumours, leukaemias, sarcomas and central nervous system (CNS) tumours.[5]

The Automated Childhood Cancer Information System (ACCIS) is a collaborative project of the European cancer registries, aiming at collection, presentation and interpretation of data on cancer incidence and adolescents in Europe.[5] In this paper we use the ACCIS database to present an overview of geographical patterns and time trends in the incidence and survival rates for cancer among European adolescents.

2. Material and methods

Detailed information on the ACCIS database is given elsewhere [Steliarova-Foucher, Kaatsch, Lacour and colleagues, this issue]. For this study, the analyses were based on data from the 49 population-based cancer registries in 16 countries, listed in Table 1, which met defined quality criteria for completeness, validity and comparability. All registrations for malignant neoplasms, together with non-malignant CNS tumours, registered during 1978–1997 in adolescents aged 15–19 years in the participating registries were extracted from the ACCIS database. A total of 15,399 registrations were included in the analyses. Standard variables available for each case included basic demographic data (age, sex, country or region of residence) and information on the tumour (date of incidence, site, morphology, basis of diagnosis, grade and laterality). In 39 registries, more than 90% of cases were microscopically verified and, in the registries with access to mortality data, fewer than 1% were registered from death certificate only (DCO). Diagnoses were grouped according to the International Classification of Childhood Cancer (ICCC).[8] The subgroup of other and unspecified carcinomas (ICCC XIf) was further divided into 13 categories to show site-specific incidence of carcinomas at a wider range of primary sites.

The contributing countries were grouped into five European regions according to geographical location, socioeconomic characteristics and data availability, as shown in Table 1. The underlying population at risk for each combination of registration area, calendar year, sex and single year of age was extracted, where available, from official statistics and otherwise was estimated by linear interpolation from available data [Steliarova-Foucher, Kaatsch, Lacour and colleagues, this issue].

For the analyses of time trends, the available time-span was divided into four periods of 5 years: 1978–1982, 1983–1987, 1988–1992 and 1993–1997. The registries included in these analyses were those contributing to at least three periods, as shown in Table 1. Quality indicators for the combined data included in the analyses of time trends are shown in Table 2, by time period and geographical region.

Incidence rates were calculated as the average annual number of cases per million person-years. The 95% confidence intervals for incidence rates were calculated using the Poisson approximation, or exactly if less than 30 cases were observed.[9] Variations in incidence between the five European regions were analysed by Poisson regression. Time trends in incidence were modelled using Poisson regression, adjusted for sex and region as appropriate, and expressed as an average annual percentage change (AAPC).

The duration of survival for each case was calculated as the time elapsed between the date of diagnosis and the date of death (if the patient died) or the closing date of the study for the given cancer registry. Survival rates were calculated using the life-table method. DCO cases and those without follow-up were excluded from the survival analyses. The extent of these exclusions can be evaluated from Tables 1 and 2. Variations in survival between groups of patients were tested by log-rank tests.[9] Change in survival between the four periods of diagnosis was tested by the log-rank test for trend,[10] using the complete survival curves. More details on the methods used can be found elsewhere [Steliarova-Foucher, Kaatsch, Lacour and colleagues, this issue].

3. Results

Table 3 presents incidence rates in Europe and the five European regions for each diagnostic group within the ICCC. Total incidence varied widely, from 169 per million in the East to 210 per million in the North. Lymphomas were the most frequent diagnostic group overall and in each region, accounting for around a quarter of all cancers. Epithelial tumours (carcinomas of sites other than kidney, liver and gonadal, together with melanoma) everywhere constituted the second most common group. The next most frequent groups were leukaemia, CNS tumours, and germ-cell and gonadal tumours, though their ordering varied between regions. These were followed by sarcomas of bone and soft tissue. There was substantial inter-regional variation in incidence rates for individual diagnostic groups; for each of the seven most frequent groups, the rate in the region with highest incidence was at least 35% higher than that in the region with lowest incidence. The widest variation was observed for CNS tumours and for germ cell and gonadal tumours. For both of these groups, Northern Europe had the highest incidence; the lowest rate for CNS tumours was in the West, while the British Isles had the lowest rate for germ cell and gonadal tumours.

Fig. 1 shows the relative frequencies of the diagnostic groups among male and female adolescents in Europe as a whole. Lymphomas were most frequent among males, but they were outnumbered by epithelial tumours among females.

The most frequent type of leukaemia was lymphoid, accounting for 56% of all leukaemias. Incidence was lowest in the East and highest in the British Isles and the South. Acute non-lymphocytic leukaemia (ANLL) accounted for 31% of leukaemias. There were no significant departures from the European average in the incidence of ANLL. Recorded incidence rates for unspecified leukaemia were low everywhere, with the highest rate in the South. Two-thirds of lymphomas were Hodgkin's disease, with the remainder being mostly non-Hodgkin's lymphoma (NHL). There was little inter-regional variation in the incidence of Hodgkin's disease, but rather more variation in NHL. The incidence of NHL was highest in the South.