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ANTI-TUMOUR TREATMENT

International patterns of cancer incidence in adolescents

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Summary International patterns of childhood cancer incidence are well documented but equivalent information relating to adolescence is scarce. This article synthesises international data on cancer in adolescents from population based cancer registries. Total incidence ranged from 95 to 255 per million person years in the series studied. The highest rates were in Australia and among Jews in Israel and the lowest in India and Japan. Lymphomas were the most frequent cancers in western industrialised countries of the northern hemisphere and in the Middle East, and occurred in substantial numbers in all other regions. Hodgkin lymphoma outnumbered non-Hodgkin in western industrialised countries but was relatively rare in most developing countries and in Japan. Leukaemias were the most frequent diagnostic group in India, East Asia and Latin America. Melanoma was the commonest cancer of adolescents in Australia and New Zealand and moderately frequent in many other predominantly white populations but rarely seen elsewhere. Kaposi sarcoma was the most frequent cancer in both sub-Saharan African series studied. The highest rates for nasopharyngeal carcinoma were in Algeria and Hong Kong and for liver carcinoma in Hong Kong and sub-Saharan Africa. Testicular germ cell tumours were relatively frequent in predominantly white populations. Central nervous system tumours and thyroid carcinoma were most often registered in countries with higher standard of living. Osteosarcoma was moderately frequent almost everywhere. Characteristic embryonal tumours of childhood and the most common carcinomas of adulthood were rarely seen. Only osteosarcoma, ovarian germ cell tumours and, in some populations, nasopharyngeal carcinoma have their highest incidence at age 15—19 years. Total cancer incidence was higher in adolescent males than females, but there was often a female excess in melanoma and thyroid carcinoma, and Hodgkin lymphoma was at least as frequent among females as males in several countries with relatively high incidence. More complete delineation of worldwide patterns of cancer in adolescence would be facilitated by availability of more data classified in a standard way to take account of morphology.

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Introduction

International patterns of childhood cancer incidence are well documented and have been studied extensively.[1–6] There have been several reports on cancer incidence among adolescents within single countries.[7–16] International comparative studies, however, are relatively scarce.[5,17,18] The aims of this article are to present and compare recent international, population-based data on cancer incidence in the 15–19 year age group, and to document and comment on time trends over past decades.

Materials and methods

Sources of incidence data

Incidence data were derived from population-based cancer registries and were taken from published sources. For Europe, the results are from the Automated Childhood Cancer Information System (ACCIS). The data for geographical patterns relate to the period 1988–1997, and those for time trends to the period 1978–1997.[18] In ACCIS, Europe was divided into five regions, namely British Isles, East, North, South and West. The results for 1988–1997 in the British Isles were from Scotland, Northern Ireland and the Republic of Ireland representing less than 15% of the total population at risk in this region, while the analysis of time trends referred to Scotland alone.[18] For the United States, use has been made of a recent report giving incidence rates for 1999–2003 among the three principal ethnic groups.[19] The data were compiled from 38 cancer registries participating in the Surveillance, Epidemiology and End Results (SEER) Program and the National Program of Cancer Registries (NPCR), which together cover 82% of the national population. Results on time trends in the United States are taken from the recent SEER monograph on cancer in adolescents and young adults, which includes data on all cancers combined and selected cancer sites among about 10% of the national population during 1975–2000.[16] For the rest of the Americas, Asia and Oceania, data are taken from the most recent volume of Cancer Incidence in Five Continents[20] and relate predominantly to the period 1993–1997. Data for African registries have been taken from the monograph on Cancer in Africa[21] since the coverage is geographically wider than in Cancer Incidence in Five Continents and some registries provided data for a longer calendar period.

Classification of diagnoses, and diagnostic categories included

The data from ACCIS were classified according to the International Classification of Childhood Cancer (ICCC),[22] but with subgroup XIf, 'Other and unspecified carcinomas', subdivided by primary site, broadly along the lines of the third edition of ICCC (ICCC-3).[23] The study followed ICCC in including all diagnoses classed as malignant in ICD-O-2 together with certain non-malignant intracranial and intraspinal neoplasms, but these tumours were not systematically registered by all contributing cancer registries. Intracranial and intraspinal germ cell tumours were grouped with germ cell tumours of other sites. Skin carcinomas were included, but were not systematically registered by a few registries (see Table 1).

The United States data in the SEER/NPCR study were classified according to ICCC-3. Malignant neoplasms as defined by ICD-O-3 were included except for myelodysplastic disorders, which were not regarded as malignant in earlier editions of ICD-O, but with the addition of pilocytic astrocytoma which had been classed as malignant in ICD-O-2 and ICCC.[19] Borderline malignant epithelial tumours of the ovary, which had been classed as malignant only in ICD-O-2, were excluded. In the SEER monograph, diagnoses were grouped according to a slightly modified version of ICCC and the standard SEER site recode.[16] Only malignant neoplasms as defined by ICD-O-2 were included. In both studies, intracranial and intraspinal germ cell tumours were grouped with germ cell tumours of other sites. Skin carcinomas were included but not analysed separately (see Table 2).

The data from Cancer Incidence in Five Continents[20] were classified mainly by site according to ICD-10 but additionally broken down by morphology for certain sites, notably bone, gonadal and CNS. Only malignant neoplasms were included. Germ cell tumours of the CNS were listed separately under that site, but all tumours of the pituitary and pineal were grouped under the heading 'Other endocrine' and not subdivided by morphology. Reporting practice for skin carcinoma and other non-melanoma skin cancers varied widely between registries (see Tables 3–6). Data from Cancer in Africa[21] were classified according to ICD-10. Non-melanoma skin cancers were routinely registered by all registries reported here (see Table 7).

Results

Geographical patterns

Total cancer incidence ranged from 105 to 264 per million in males and from 85 to 228 per million in females. The lowest rates were found in India and Japan for both sexes, while Algeria and mainland China also had incidence below 100 per million in females. The highest rates for both sexes were in Australia. In the United States, the incidence rates for both sexes were highest in non-Hispanic Whites, intermediate in Hispanics, and lowest in non-Hispanic Blacks. Incidence was higher in males than in females in all the data sets except for Uganda.

Incidence of leukaemia ranged from under 10 per million in Algeria and Uganda to over 35 per million in Hispanic populations of the Americas. In the United States, incidence among non-Hispanic Whites was higher than among non-Hispanic Blacks. In Europe, incidence was highest in the British Isles and the South and lowest in the East. Most of the variation between populations was accounted for by lymphoid leukaemia, which in this age group is virtually synonymous with acute lymphoblastic leukaemia (ALL). Lymphoid leukaemia was the most frequent subgroup in most populations but the excess was greatest among Hispanic populations and in Oman. In Japan, mainland China and Zimbabwe, ALL was less frequent than acute myeloid leukaemia (AML). AML had relatively constant incidence worldwide and was the only other subtype to have incidence consistently above 5 per million. Leukaemia was more frequent among males than