

## Trends in Childhood Cancer Incidence: Review of Environmental Linkages

Irena Buka, MB, ChB, FRCPC<sup>a,b,\*</sup>,  
Samuel Koranteng, MB, ChB<sup>a</sup>,  
Alvaro R. Osornio Vargas, MD, PhD<sup>c</sup>

<sup>a</sup>*Paediatric Environmental Health Specialty Unit, Misericordia Hospital,  
3 West, 16940 – 87 Avenue, Edmonton, AB T5R 4H5, Canada*

<sup>b</sup>*Department of Paediatrics, University of Alberta, Edmonton, Alberta, Canada*

<sup>c</sup>*División de Investigación Básica, Instituto Nacional de Cancerología, Mexico City, Mexico*

Cancer in children is rare and accounts for about 1% of all malignancies. In the developed world, however, it is the commonest cause of disease-related deaths in childhood, carrying with it a great economic and emotional cost [1]. Declines in mortality for childhood cancers relate to improved survival with current treatment modalities [2,3].

In the United States each year 150 of every 1 million children under the age of 20 years are diagnosed with cancer, with a predominance in males [2]. In Europe, it is estimated that 157 per million children under the age of 20 years develop cancer annually, males predominantly [3]. Higher cancer rates occur in children younger than 5 years of age and again in children aged 15 to 19 years, with rates for 5- to 9-year-olds and 10- to 14-year-olds being fairly similar and lower [2]. The commonest malignancies are leukemia, central nervous system (CNS) tumors, and lymphomas, accounting for approximately 57% of all cases in those less than 20 years of age in Europe [3] and for 62.6% of cases in the same age cohort in the United States [2]. Gender and age trends may vary for specific cancers (eg, in Hodgkin's disease [HD], males predominate in those diagnosed under 15 years of age but females predominate in the 15- to 19-year-old age groups [2]).

Concern has been raised in the United States and Europe that overall rates of childhood cancer have been increasing since the 1970s [2–6]. The study of environmental links with respect to cancer has increased during

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\* Corresponding author. Paediatric Environmental Health Specialty Unit, Misericordia Community Hospital, 3 West, 16940 – 87 Avenue, Edmonton, AB T5R 4H5, Canada.

E-mail address: [ibuka@cha.ab.ca](mailto:ibuka@cha.ab.ca) (I. Buka).

the same time period. In vitro studies have demonstrated radiation-induced chromosomal aberrations and mutations in peripheral blood lymphocytes [7,8]. Reports of body burdens of chemicals highlight children's exposures to carcinogens [9]. The study of trends in incidence may be a clue to identifying environmental links.

Linnet and colleagues [10] reported a modest rise in the incidence of childhood leukemia resulting from an abrupt increase from 1983 to 1984, although 1989 rates declined. For CNS tumors, rates rose between 1983 and 1986 with statistical significance. Rates for certain skin cancers rose significantly, but the incidence of HD decreased modestly (Fig. 1).

Studies of temporal trends in the incidence of childhood leukemia have been inconsistent. An average annual 0.7% increased incidence of acute lymphoblastic leukemia (ALL) ( $P = .005$ ) was reported by McNally and colleagues [11] from the Manchester Children's Tumor Registry in the United Kingdom from 1954 to 1998. Magnani and colleagues [12] reported a 2.6% annual increase in the incidence rate of ALL in the 1- to 4-year-old age group (95% confidence interval [CI], 1.13–4.13) in Piedmont Northwest Italy between 1975 and 1998. Hjalgrin and colleagues [13], however, found stable rates of leukemia in Nordic countries (Sweden, Denmark, Norway,

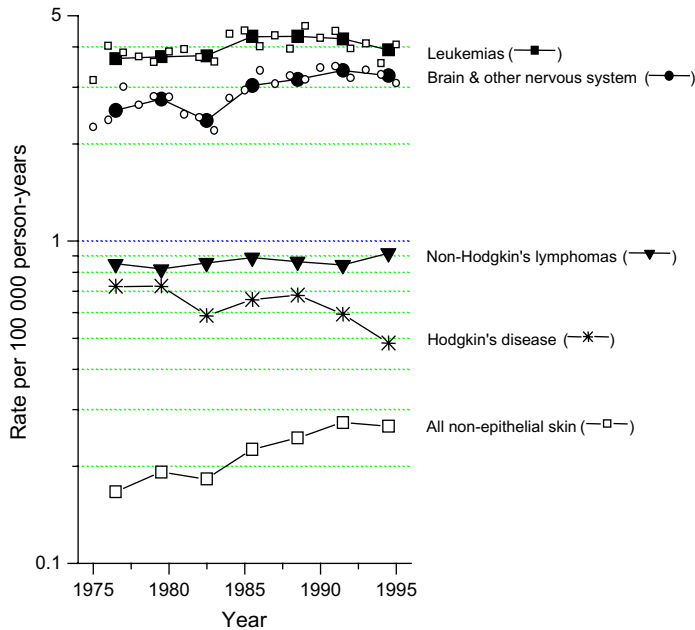


Fig. 1. Incidence of various childhood cancers, 1975–1995. (Adapted from Linet MS, Ries LAG, Smith MA, et al. Cancer Surveillance Series: recent trends in childhood cancer incidence and mortality in the United States. J Natl Cancer Inst 1999;91(12):1052; with permission of Oxford University Press.)

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