

Incidence Rate and Distribution of Common Cancers among Iranian Children

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Abstract

Background: Geographic differences in the incidence of cancers may suggest unique genetic or environmental exposures that impact the risk of acquiring cancer. This research aims to determine the incidence rate and geographical distribution of common cancers among Iranian children.

Methods: In this ecological study, we extracted data that pertained to the incidence rate of common cancers among children from reports by the National Registry of Cancer and Disease Control and Prevention in 2008. A map of the cancer incidence rates was designed by using geographic information system.

Results: The most common cancer sites among children were the hematology system, brain and central nervous system, and lymph nodes. The central provinces had the lowest cancer incidences.

Conclusion: The considerable variation in incidence of childhood cancers in Iran suggests a possible potential environmental risk factor or genetic background related to this increased risk among children.

Keywords: Childhood cancer, Epidemiology, Incidence

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Introduction

Incidence rates of cancer differ among various ethnic groups within a country and various countries; these differences may be due to different

environmental factors, genetic predisposition, and early or delayed exposure to infectious diseases.¹

Globally, the annual number of new cases of childhood cancer

exceeds 200,000 of which more than 80% of these occur in developing countries.² The incidence of childhood cancers among different countries varies, with a range of 75 to 150 per million children per year.³ In England only 0.5% of all cancers occur in children less than 15 years of age, while in India this proportion is higher at 1.6%-4.8%.⁴ In general, cancer is more common in boys than girls. The male to female ratio in high Human Development Index (HDI) countries is around 1.2:1.² In developed countries, leukemia, brain and other central nervous system (CNS) tumors, as well as lymphomas are the most common cancers among children.² The causes of most childhood cancers are not known. Various studies report contradictory results for environmental risk factors, parental exposure with chemical substances such as pesticides, childhood exposure with common infectious agents, and residence in close proximity to a nuclear power plant.^{5,6}

Geographic differences in the incidence of cancers may suggest unique genetic or environmental exposures that affect the risk of

cancer; therefore, the aim of this research is to determine the incidence rate and geographical distribution of common cancers among Iranian children.

Materials and Methods

In this ecological study, we extracted data about the incidence rates of common childhood cancers from reports of the National Registry of Cancer (NCR) and Disease Control and Prevention in 2008. Average annual age-standardized incidence rate (ASR) per 100,000 person-years was calculated by the direct method using the World Standard Population.⁷ We used the geographic information system (GIS) version 10.3 to map the ASR of common cancers according to gender.

Results

According to the NCR reports in 2008, the three most common sites for pediatric cancers were the hematology system, brain and CNS, and lymph nodes. Boys had a higher incidence rate for these three cancers compared to girls (Table 1). As

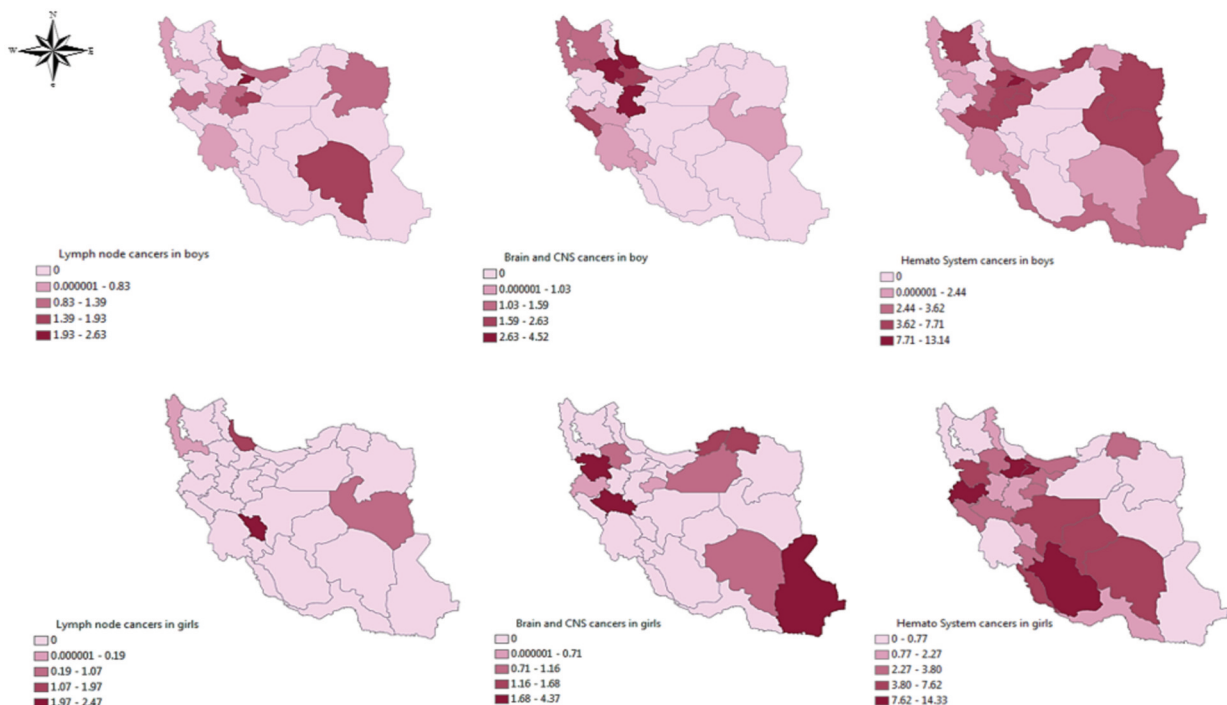


Figure 1. Maps of childhood cancers per 100,000 population in Iran.

Table 1. Incidence rate per 100,000 for the three most common cancer sites among children in Iran (2008).

Parameter	Organ System	Hematology	Brain and CNS	Lymph node
0-4	Boys	3.93	1.18	0.5
	Girls	3.9	0.77	0.18
5-9	Boys	3.42	1.24	1.37
	Girls	2.72	1.13	0.33
10-14	Boys	2.48	0.98	0.98
	Girls	1.51	0.79	0.48

shown in Figure 1, there was no regular geographical distribution for the incidence of cancers. In general, the central provinces had lower incidences of cancers.

Discussion

This study aimed to determine the incidence rate and geographical distribution of common cancers in Iranian children. The results showed that the hematology system, brain and CNS, and lymph node were the three main common cancer sites among Iranian children, which supported results of studies conducted in this field in Iran and worldwide. Moradi et al., in a study conducted in Golestan (Iran), reported the most frequent childhood cancers to be leukemia, lymphomas, and CNS tumors.⁸ Ghasemi et al. reported the cancer pattern in children from Sari (Mazandaran) from 2001-2010. They indicated that among children age 0-14 years, the most prevalent malignancy was leukemia and lymphoma.⁹ However, another study reported a higher incidence of CNS tumors, malignant bone tumors, and soft tissue sarcomas.¹⁰ A study in Mexico reported that the principal groups of neoplasms included leukemia, CNS tumors, and lymphomas.¹¹ The German Childhood Cancer Registry (GCCR) during 1980-2005 reported the three top cancers to be leukemia, CNS tumors, and lymphomas.¹² The most common childhood cancers in the United States during 1995 were acute leukemia, CNS tumors, and lymphomas.² The results of the Surveillance, Epidemiology, and End Results (SEER) program during 1975-95 showed that leukemia, CNS tumors, and

lymphomas ranked first among childhood cancers.¹³ Hematology, brain and CNS, and lymph node malignancies are the most common malignancies in Iranian children. The majority of studies have been conducted on these malignancies. Additional studies are needed to determine the causes of these cancers and their associated risk factors. As long as their causes are not known, prevention and treatment interventions cannot be effectively developed. It is necessary to pay more attention to measures related to early diagnosis, screening, effective treatment, and palliation in order to decrease the incidence of childhood cancers in Iran.

In this study, boys had higher incidence rates compared to girls in all three cancer types (hemato system, brain and CNS, and lymph node). These results approximated those observed in Golestan Province (Iran) as reported by Moradi et al.⁸ and another study in Mexico from 1998-2000.¹¹ Farahmand et al. reported a more prevalent rate of cancer incidence in boys than girls.¹⁴ Fathi et al. stated that most cancers were seen in boys (61.5%).¹⁵ Genetic differences in immune function might be responsible for the increased incidence in boys or the related behavioral differences between boys and girls. This study suggested that due to the higher cancer incidence in boys, more attention to the causes of this problem, along with screening and prevention programs should be undertaken more seriously in children, particularly for boys. We recommend that additional studies should be performed in order to clarify the causes for this difference.

In this research, the central provinces of Iran

had lower incidences of childhood cancers. In general, the geographical distribution of cancers in Iran showed that central regions had lower incidences of cancer compared to the Northwest and Northeast areas of Iran.¹⁶ These differences in geographical distribution might be caused by differences in genetic and environmental factors such as diet, behavioral patterns and cultural context, in addition to differences in access to screening centers and health care systems among other factors. Therefore, future studies should investigate the effects of geographical differences on the childhood cancer incidence rates and high mortality rate.

Conclusion

The considerable variation in incidence across provinces suggests a possible potential environmental risk factor or genetic backgrounds are associated to the increased cancer risk among children. Ecological studies are the basis for development of hypotheses, therefore these results should be confirmed by analytical studies.

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Conflict of Interest

No conflict of interest is declared.

References

- Howard SC, Metzger ML, Wilimas JA, Quintana Y, Pui CH, Robison LL, et al. Childhood cancer epidemiology in low-income countries. *Cancer*. 2008;112(3):461-72.
- Pizzo PA, Poplack DG. Principles and practice of pediatric oncology. *J Am Coll Surg*. 1997;2(185):203-4.
- Ward E, DeSantis C, Robbins A, Kohler B, Jemal A. Childhood and adolescent cancer statistics, 2014. *CA Cancer J Clin*. 2014;64(2):83-103.
- Arora R, Eden T, Kapoor G. Epidemiology of childhood cancer in India. *Indian J Cancer*. 2009;46(4):264-73.
- Ma X, Urayama K, Chang J, Wiemels JL, Buffler PA. Infection and pediatric acute lymphoblastic leukemia. *Blood Cells Mol Dis*. 2009;42(2):117-20.
- Belson M, Kingsley B, Holmes A. Risk factors for acute leukemia in children: a review. *Environ Health Perspect*. 2007;115(1):138-45.
- Boyle P, Parkin DM. Cancer registration: principles and methods. *Statistical methods for registries. IARC Sci Publ*. 1991;(95):126-58.
- Moradi A, Semnani S, Roshandel G, Mirbehbehani N, Keshtkar A, Aarabi M, et al. Incidence of childhood cancers in golestan province of Iran. *Iran J Pediatr*. 2010;20(3):335-42.
- Ghasemi M, Karami H, Abedian-Kenari S, Kianifar S. Patterns of cancer in the children admitted in Avicenna hospital in Sari, Iran, between 2001 and 2010. *Int J Hematol Oncol Stem Cell Res*. 2011;5(2):29-33.
- Punia RS, Mundi I, Kundu R, Jindal G, Dalal U, Mohan H. Spectrum of nonhematological pediatric tumors: A clinicopathologic study of 385 cases. *Indian J Med Paediatr Oncol*. 2014;35(2):170-4.
- Fajardo-Gutiérrez A, Juárez-Ocaña S, González-Miranda G, Palma-Padilla V, Carreón-Cruz R, Ortega-Alvárez MC, et al. Incidence of cancer in children residing in ten jurisdictions of the Mexican Republic: importance of the Cancer registry (a population-based study). *BMC Cancer*. 2007;7:68.
- Spallek J, Spix C, Zeeb H, Kaatsch P, Razum O. Cancer patterns among children of Turkish descent in Germany: a study at the German Childhood Cancer Registry. *BMC Public Health*. 2008 ;8:152.
- Ries LAG, Smith MA, Gurney J, Linet M, Tamra T, Young J, et al. Cancer incidence and survival among children and adolescents: United States SEER Program 1975-1995, In: National Cancer Institute, SEER Program. Bethesda, MD: NIH pub. No. 99-4649;1999.
- Farahmand M, Almasi-Hashiani A, Hassanzade J, Moghadami M. Childhood cancer epidemiology based on cancer registry's data of Fars province of Iran [Article in Persian]. *Koomesh*. 2011;13(1):8-13.
- Fathi A, Bahadoram M, Amani F. Epidemiology of Childhood Cancer in Northwest Iran. *Asian Pac J Cancer Prev*. 2015;16(13):5459-62.
- Mousavi SM, Gouya MM, Ramazani R, Davanlou M, Hajsadeghi N, Seddighi Z. Cancer incidence and mortality in Iran. *Ann Oncol*. 2009;20(3):556-63.