

THE EPIDEMIOLOGY OF CHILDHOOD CANCERS

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In Turkey, every year 150.000 adult cancer cases are expected whereas approximately 2.500–3.000 cancer cases are expected for the 0-14 age group. The cancer frequency in children under the age 15 is between 110-150 per million. Compared to adults, cancer is observed less frequently in children; 0.5% of all cancer cases are detected in children under the age of 15. On the other hand, the high rate of successful treatment and the length of expected life for children increase the significance of early and effective treatment, access to good service, the quality of life and psychosocial approach even more. Although cancer is not the second cause of death in Turkey, unlike the United States and many other developed countries, it is among the top four (Table 1). As the level of development of Turkey increases, cancer tends to climb upwards in the list. Within this framework, all individuals and disciplines conducting studies on childhood cancers have crucial tasks.

Table 1. Causes of death in children of 1-14 age group in Turkey, 2002
(Mortality Statistics in Province and Town Centers, 2002. Republic of Turkey Prime Ministry State Statistics Institute, Ankara)

Cause of Death	Relative frequency (%)
Infectious Diseases	25.1
Cardiological Diseases	20.8
Accidents	13.9
Cancer	7.2
Cerebrovascular Diseases	4.3
Others	28.7

According to the international childhood cancers classification, childhood cancers are studied under 12 main groups (Table 2). The most frequent types are leukemia, nervous system tumors and lymphomas. Although most of the adult tumors are carcinomas, the most of these are embryonic

tumors. Genetic origin is more evident in children than adults. Chromosome defects, immunological deficiencies, neurofibromatosis are among the causes of susceptibility. On the other hand, exposure to atomic bomb, nuclear accidents such as Chernobyl, etc. increase the frequency of cancers, especially thyroid cancers and leukemias.

Table 2. International classification of childhood cancers (ICCC, 1996)

1. Leukemias
 2. Lymphomas
 3. Brain and spinal canal tumors
 4. Sympathetic system tumors
 5. Retinoblastoma
 6. Renal tumors
 7. Liver tumors
 8. Bone tumors
 9. Soft tissue sarkomas
 10. Tumors with gonad and germ cells
 11. Epithelial tumors
 12. Other malign neoplasms
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Annual incidence of childhood cancers in Cyprus, Israel (Jewish), Israel (Arabic), Egypt, Jordan, Italy, Spain, France and Turkey are reported as 170, 133.3, 119.9, 130.9, 114.8, 158, 137.9, 135.6 and 115.6 per million respectively. The incidence is 130.9 and 153.3 per million for Europe and US respectively (SEER data). The frequency of lymphoproliferative tumors in some Middle Eastern and Mediterranean countries is higher. The ACCIS project have made society based cancer registries from 63 European countries during 1970-1999, and determined a 1% increase in cancer incidence. The survival rates have significantly improved since 1970 and reached to about 80%. However, evident differences between the survival rates in childhood cancers in developed and developing countries are reported. Therefore, sharing information and resources, technology transfer and comprehensive oncology services have strategic importance for improving survival rates and the quality of life in developing countries. Cooperation between various oncology disciplines would make a great contribution to this end.

1274 cancer cases of 0–19 age group were reported to the Ministry of Health in 1999 (Table 3). This figure is below the total number of cases that should be reported.

Table 3. Cancer frequency in children in Turkey (The Ministry of Health, 1999)

Age	Frequency	Incidence*
0-4	342	5.17
5-9	313	5.54
10-14	266	4.00
15-19	353	5.22
Total	1274	

* per one hundred thousand

Table 4 presents the data of the cases except leukemias observed in 30 years at Hacettepe University Oncology Institute, Department of Pediatric Oncology, which is one of the largest centers in Turkey. It should be noted that lymphomas have been observed more frequently than CNS tumors. Of course this data does not represent the country, but similar distributions are reported also by other centers.

Table 4. The distribution of childhood cancers observed at Hacettepe University Oncology Institute, Department of Pediatric Oncology between 1971 and 2000 (Kutluk MT, Med Ped Oncol 39:317, 2002)

Type of Tumor	Frequency	%
Lymphoma	2036	34.7
CNS tumors	820	14.0
Soft tissue sarcomas	569	9.7
Renal tumors	557	9.5
Sympathetic system tumors	551	9.4
Germ cell tumors	391	6.7
Bone tumors	351	6.0
Carcinoma and other epithelial	228	3.9
Retinoblastoma	155	2.6
Liver tumors	92	1.6
Rare tumors	37	0.6
Unclassified tumors	72	1.2
Total	5859	100.0

The distribution of leukemias observed at the Pediatric Hematology Unit of the same university is shown in Table 5.

Table 5. The distribution of leukemias observed at Hacettepe University Pediatric Hematology Unit (1980-2003)

Type	Freq.	Per cent	Sex (M/F)	Mean±SD*	Median**	Distrib.*
ALL	548	%74.2	60.2/39.8	77.7±48.3	62.0	1.0-192.0
AML	135	%18.3	62.2/37.8	108.4±51.6	108.0	8.0-192.0
KML	13	% 1.8	61.5/38.5	99.2±58.6	108.0	14.0-180.0
MDS	43	% 5.8	51.2/48.8	81.8±56.5	72.0	1.0-192.0
Total	739	%100.0	60.1/39.9	84.0±50.9	72.0	1.0-192.0

** monthly

In 2002, Hacettepe University established on “hospital base” the Hacettepe Hospitals Cancer Registry system covering all of its three hospitals. Even though both adult and children cancer cases reported to the Ministry of Health were 210 in 2002, the number of cases rose to 4200 in 2006. Table 6 presents the distribution of childhood cancers observed at Hacettepe Hospitals in 2004. Central nervous system tumors have become the most frequently observed tumors as shown in the Table. This fact is related to the number of cases referred to this center.

Table 6. Childhood tumors observed at Hacettepe University Hospitals in 2004 (Hacettepe University Hospitals Cancer Registry system, 2004)

Types of Tumors	Male		Female		Total	
	#	%	#	%	#	%
Leukemia	16	13.01	10	10.00	26	11.65
Lymphoma/RES	14	11.38	16	16.00	30	13.45
CNS/intracranial/intraspinal	40	32.52	25	25.00	65	29.14
Sympathetic tumors	1	0.81	3	3.00	4	1.79
Retinoblastoma	10	8.13	5	5.00	15	6.72
Renal tumors	10	8.13	5	5.00	15	6.72
Liver tumors	6	4.88	4	4.00	10	4.84
Malign bone tumors	4	3.25	5	5.00	9	4.03
Soft tissue sarcomas	6	4.88	8	8.00	14	6.27
Germ cell						
/trophoblastic/gonadal	2	1.63	6	6.00	8	3.58
Carcinoma/other epithelial	12	9.76	11	11.00	23	10.31
Other unspecified	2	1.63	1	1.00	3	1.34
Unknown	0	0	1	1.0	1	0.44
Total	123	100.0	100.0	100.0	223	100.0

The cancer registries of İzmir Cancer Registry Center have been an important source both on adults and children in Turkey. Tables 7 and 8 summarize these data.

Table 7. Childhood cancers (0-14 years of age), İzmir 1993-1994

Cancer type	Number of cases		Relative Frequency (%)	Annual rate of incidence Standardized (per million)
	Total (n)	Male/Female n (%) / n (%)		
Leukemia	60	37 (62)/23 (38)	34.9	42.9
Acute lymphocytic	47	29 (62)/18 (38)	27.3	34.4
Lymphoma	26	19 (73)/7 (27)	15.1	18.4
Hodgkin's disease	12	8 (67)/4 (33)	7.0	8.6
Burkitt lymphoma	3	3 (100)/0 (0)	1.7	2.0
Other HDL	11	8 (73)/3 (27)	6.4	7.8
Cerebral spinal tumors	28	11 (39)/17 (61)	16.3	19.8
Astrocytoma	11	5 (45)/6 (55)	6.4	7.7
PNET	10	4 (40)/6 (60)	5.8	7.3
Neuroblastoma	13	6 (46)/7 (54)	7.6	11.7
Wilm's tumor	9	3 (33)/6 (67)	5.2	7.9
Retinoblastoma	4	2 (50)/2 (50)	2.3	3.4
Hepatic tumors	2	1 (50)/1 (50)	1.2	1.5
Bone tumors	4	2 (50)/2 (50)	2.3	2.2
Soft tissue sarcoma	12	5 (42)/7 (58)	7.0	8.0
Germ c./gonadal tumors	7	3 (43)/4 (57)	4.1	5.3
Carcinoma	7	5 (71)/2 (29)	4.1	4.1
Total	172	94 (55)/78 (45)	100.0	125.0

HDL: Non-Hodgkin's Lymphoma; PNET: Primitive neuroectodermal tumor

Table 8. Childhood cancers (İzmir Cancer Registry Center), 1993-1996

ICCC* Group	Age	Standardized Incidence (per million)**
	0-14age	0-19age
All tumors	115.6	119.5
I Leukemia	41.4	36.2
Ia Lymphoid	33.4	28.0
Ib Acute myeloid	5.7	6.3
II Lymphoma	19.6	21.2
IIa Hodgkin	8.5	8.1
# Non-Hodgkin	11.0	12.7
III CNS tumors	16.8	17.0
IVa Neuroblastoma	7.6	5.9
V Retinoblastoma	3.3	2.6
VIa Wilms' tumor	6.7	5.2
VIII Bone tumor	3.9	9.0
VIIIa Osteosarcoma	1.4	4.2
VIIIc Ewing tumor	2.5	3.4
IX Soft tissue sarcomas	7.6	8.1
IXa Rhabdomyosarcoma	3.5	4.0
X Germ cell tumors	4.1	5.4
## Carcinoma and epithelial tumors	3.1	7.0
XIb Thyroid	0.5	2.1
XId Melanoma	0.0	0.8

* ICCC: "International classification of childhood cancer"

** Rates calculated with less than 10 cases are given in italics;
total population of 0-19 years of age: 1003798

IIb: Non-Hodgkin; IIc: Burkitt; IId: Other

Renal (VIb), hepatic (VIIb) and other (XI)

In Turkey, while an opinion about the distribution of childhood cancers was formed in previous years by aggregating the statistics provided by large centers and the cancer registries of the Ministry of Health, the Pediatric Tumor registries started by Turkish Pediatric Oncology Group has structured a crucial stage since 2002. Turkish Pediatric Oncology Group and Turkish Pediatric Hematology Group have been keeping the childhood cancer registries together since 2005. This registry system will constitute a significant database on the distribution of childhood cancers and survival rates in following years.

According to the data collected from 33 centers by the Turkish Pediatric Oncology Group, 1073 cases were registered in 2002; the distribution of tumors is shown in Table 9. A crucial result that can be derived from these registries is that lymphomas were observed more frequently than central nervous system tumors. But this data should be interpreted carefully. The fact that central nervous system tumors are sent less frequently to pediatric oncologists should be investigated. The median age for all cases is 6.4, while the male-to-female ratio is found to be 1.39. The most frequently observed tumors among carcinomas and within the group labeled as the others are liver tumors and nasopharynx carcinomas. The 1-year survival rate of 1073 cases reported by 33 centers was found as 77% (Figure 1). In consideration of the long-term survival rates reaching to 75-80% in developed countries, the state and other organizations have crucial tasks and also interdisciplinary cooperation is required in order to improve the survival rate of children with cancer in Turkey where 2.500 - 3.000 childhood cancer cases are expected annually. Consequently, the Pediatric Tumor registries implemented jointly by Turkish Pediatric Oncology Group and Turkish Pediatric Hematology Association will become an important source for Turkey.

Table 9. Tumor types in 1073 children with lymphoma and solid tumors (T. Kutluk, Turkish Pediatric Oncology Group Pediatric Tumor Registries, 2002)

Tumor type	Male/female	Frequency	%
Lymphoma	195/92	287	26.80
HDL	124/57	181	16.90
Hodgkin	71/35	106	9.90
M. histiocytosis	1/0	1	0.10
CNS tumors	134/93	227	21.10
Sympathetic nervous system tumors	49/52	101	9.40
Soft tissue tumors	46/35	81	7.50
Renal tumors	35/41	76	7.10
Osteocarcoma	37/23	60	5.60
Ewing tumor	27/18	45	4.20
Chondrocarcoma	1/0	1	0.10
Retinoblastoma	18/31	49	4.60
Germ cell tumors	34/31	65	6.10
Liver	18/5	23	2.10
Carcinoma / Other	29/28	57	5.30
Total	624/449	1073	100.00

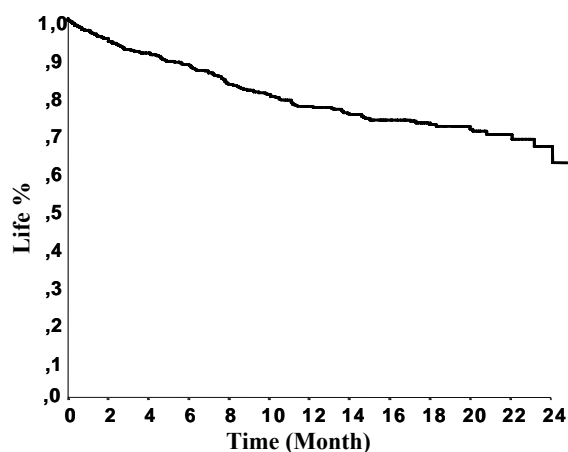


Figure 1. The survival terms of children with cancer in Turkey (T. Kutluk, Turkish Pediatric Oncology Group Pediatric Tumor Registries, 2002)

The initial data for 2005 of the Pediatric Tumor Registry research conducted by the Turkish Pediatric Oncology Group and the Turkish Pediatric Hematology Association is summarized in Table 10 (there are still certain deficiencies in these data and their analyses still continue).

Table 10. Turkish Pediatric Oncology Group (TPOG)/Turkish Pediatric Hematology Association (TPHD) Pediatric Cancer Registries, 2005 (T. Kutluk and A. Yesilipek, on behalf of TPOG/TPHD)

	Tumor types	#	%
I	Leukemia	391	27.2
II	Lymphoma/RES	240	16.7
III	CNS/Intracranial/Intraspinal	166	11.6
IV	Sympathetic system	152	10.6
V	Retinoblastoma	40	2.8
VI	Renal tumors	77	5.4
VII	Hepatic tumors	13	0.9
VIII	Malignant bone tumors	74	5.2
IX	Soft tissue sarcomas	111	7.7
X	Germ Cell/Trophoblastic/Other gonads	67	4.7
XI	Carcinoma/other malign epithelial	68	4.7
XII	Other/non-specified malign	29	2.0
	LCH	7	0.5
Total		1435	100.0

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