

PEDIATRIC CANCER IN IDAHO 2006-2015

A Publication of the



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The Idaho Hospital Association (IHA) contracts with, and receives funding from, the Idaho Department of Health and Welfare, Division of Public Health, to provide a statewide cancer surveillance system: the Cancer Data Registry of Idaho (CDRI).

The statewide cancer registry database is a product of collaboration among many report sources, including hospitals, physicians, surgery centers, pathology laboratories, and other states in which Idaho residents are diagnosed or treated for cancer. Their cooperation in reporting timely, accurate, and complete cancer data is acknowledged and sincerely appreciated.

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IDAHO DEPARTMENT OF
HEALTH & WELFARE

Pediatric Cancer in Idaho, 2006-2015

Although relatively rare in comparison with cancer in older adults, cancer is the second leading cause of death in persons aged 1-14 years. The epidemiology of cancer among children differs markedly from that of adults, both in the patterns of anatomic sites involved and the predominant histologic types. Most notably, the tumors diagnosed in children frequently involve the hematopoietic and central nervous systems or are of mesenchymal origin. In contrast, malignancies of epithelial tissues, which are predominant in adults, are uncommon in children. Similar to adult cancers, the etiology of many childhood cancers remains unclear.

The Cancer Data Registry of Idaho (CDRI) receives several requests per year from physicians and others for data on pediatric cancer incidence for the state of Idaho. This report describes the incidence of pediatric cancers in Idaho, with comparisons to data from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program and the US Centers for Disease Control and Prevention's National Program of Cancer Registries (NPCR).^{1 2} SEER currently publishes cancer incidence and survival data from population-based cancer registries covering approximately 34 percent of the US population and is considered the standard for quality among cancer registries around the world. NPCR supports central cancer registries in 46 states, the District of Columbia, Puerto Rico, the U.S. Pacific Island Jurisdictions, and the U.S. Virgin Islands. These data represent 97% of the U.S. population. Together, NPCR and SEER collect data for the entire U.S. population. Combined NPCR and SEER data are used in this report for pediatric cancer incidence rankings by state.

METHODS

The data analyzed for this report include cancers diagnosed between 2006 and 2015 among Idaho residents less than 20 years of age. Cases were grouped according to the International Classification of Childhood Cancer (ICCC) based on site and morphology coded according to ICD-O-3.³

A total of 911 cases were diagnosed among Idaho resident children under the age of 20 between 2006 and 2015. This number includes 814 malignant cancers and 79 benign and borderline behavior neoplasms. It was not possible to assign a group code of the ICCC system to 19 cases. Eighteen cases were in situ, which are not included in the ICCC system. Health District was assigned from county of residence at time of diagnosis. All Idaho incidence rates presented were calculated per million population, and are averages for the period 2006 through 2015 (rates per million, rather than per 100,000, are commonly used for pediatric cancers). Age-adjustment was performed using the direct method to the 2000 U.S. standard population. Cancer incidence, mortality and survival statistics were calculated using SEER*Stat.⁴ State rankings were obtained from the NPCR and SEER Incidence Public Use Data File.

RESULTS

A total of 874 cases that met the study criteria were diagnosed among Idaho residents aged less than 20 years between 2006 and 2015, yielding an overall age-adjusted rate of 186.0 cases per million population (Table 1). In comparison, the SEER rate for Whites was 221.6 cases per million population for 2013-2015. The distribution of pediatric cancers by ICCC grouping was very similar for Idaho and SEER Regions. Idaho's pediatric rate of lymphomas and reticuloendothelial neoplasms (ICCC major classification category II) was about 30% lower than the rate for SEER Whites. For no other ICCC category did Idaho show a statistically significantly different rate from SEER Regions based on the comparison of 95% confidence intervals.

For all races combined, Idaho ranked 32nd highest among states in pediatric (ages 0-19) cancer incidence 2006-2014. This result is partially related to differences in the distribution of race by state. Pediatric cancer incidence is higher among Whites, and Idaho has a higher proportion of White residents than many states. Among Whites, Idaho ranked 35th in pediatric cancer incidence.

Over 80% of children aged less than 20 years diagnosed with malignant cancer survived at least 5 years after their diagnosis, both in Idaho and SEER Regions (Table 2 and Figure 1). For no ICCC major classification category, nor overall, was there a statistically significant difference in 5-year relative survival between Idaho and SEER cases.

Table 3 and Figure 2 show malignant pediatric cancer incidence in Idaho and SEER Regions by year of diagnosis for 2006 to 2015. Idaho incidence rates are slightly lower than SEER rates for most years and show more variability year-to-year due to smaller numbers of cases. Pediatric cancer incidence increased at a rate of about 0.6% per year in Idaho from 1975 to 2015. This parallels the long-term increase observed in SEER Regions from 1973 to 2015 of about 0.7% per year.

Table 4 shows pediatric cancer incidence in Idaho by health district for the ICCC major classification categories for the period 2006 to 2015. Health District 4 had a statistically significantly higher rate of pediatric cancer incidence and Health District 2 had statistically significantly lower rate. Health District 1 had a statistically significantly higher incidence rate of hepatic tumors. Health District 3 had a statistically significantly lower rate of ICCC classification category IX – soft tissue and other extraosseous sarcomas. For Health District 4, the significantly higher overall rate was due to higher rates for melanomas and thyroid carcinomas. Lower rates of these cancers in Health Districts 2 and 6 may indicate underreporting. Health District 6 also had a significantly lower incidence rate of ICCC classification category I - leukemias, myeloproliferative & myelodysplastic diseases. CDRI is working to increase reporting of cancer cases by pathology laboratories and physicians statewide. The overall lower rate of pediatric cancer incidence in Health District 2 may be due to cases being treated in Washington State and not being reported to Idaho via interstate data exchange. CDRI is exploring alternate means for capturing information on any such cases. For no other ICCC major classification category was there a statistically significant difference between any health district and the state of Idaho.

From 2006 to 2016, 106 of Idaho's children aged 0-19 died from some form of cancer (Table 5).⁵ The leading types of cancer mortality were brain and other central nervous system and leukemia (data not shown). While pediatric cancer incidence rates have increased over time, mortality rates have decreased. Figure 3 depicts trends in pediatric cancer mortality rates from 2006 to 2016. The annual rates plotted for Idaho demonstrate large year-to-year variability that is expected due to the relatively small numbers of deaths per year. From 1975-2015, pediatric cancer mortality rates decreased about 2% per year, in Idaho and the U.S.⁶ Idaho ranked 50th highest (second lowest) among states and the District of Columbia in pediatric (ages 0-19) cancer mortality 2006-2015.

CONCLUSIONS

These data demonstrate strong similarity in pediatric cancer incidence and survival patterns between Idaho and SEER Regions. Compared with cancer in adults, there is less geographic variability in pediatric cancer incidence. Some children have a hereditary predisposition of cancer. A 2015 study that tested children and adolescents with cancer revealed that 8.5% had predisposing gene mutations: 16.7% in patients with non-CNS solid tumors, 8.6% in patients with CNS tumors, and 4.4% in patients with leukemia.⁷

Largely because of improvements in therapy for pediatric cancers, there has been a decrease in mortality rates over time. Data collected by CDRI for 2016 show that over 20% of pediatric patients participated in clinical trials, a rate much higher than that for adults (2%).

While over 80% of children diagnosed with cancer survive at least five years, it has been shown that adult survivors of childhood cancer have higher prevalence of adverse health outcomes later in life and are at risk for higher health care expenditures and lost productivity, compared to adults without a history of cancer.^{8 9} Education, intervention programs, and ongoing follow-up care are important for improving health and economic outcomes associated with cancer survivorship in this population.

Table 1. Pediatric (Ages 0-19) Cancer Incidence in Idaho and SEER Regions

Site/Type of Cancer	Idaho 2006-2015			SEER 2013-2015		
	Rate	Cases	Pop	Rate	Cases	Pop
All Sites Combined	186.0	874	4,696,467	221.6	5,239	23,573,317
I Leukemias, myeloproliferative & myelodysplastic diseases	46.5	221	4,696,467	53.3	1,260	23,573,317
I(a) Lymphoid leukemias	36.8	175	4,696,467	40.3	954	23,573,317
I(b) Acute myeloid leukemias	5.7	27	4,696,467	8.3	196	23,573,317
I(c) Chronic myeloproliferative diseases	1.5	7	4,696,467	1.4	32	23,573,317
I(d) Myelodysplastic syndrome and other myeloproliferative	1.5	7	4,696,467	1.3	31	23,573,317
I(e) Unspecified and other specified leukemias	1.0	5	4,696,467	2.0	47	23,573,317
II Lymphomas and reticuloendothelial neoplasms	23.1	107	4,696,467	31.8	751	23,573,317
II(a) Hodgkin lymphomas	11.5	53	4,696,467	12.1	285	23,573,317
II(b) Non-Hodgkin lymphomas (except Burkitt lymphoma)	7.7	36	4,696,467	10.8	254	23,573,317
II(c) Burkitt lymphoma	1.3	6	4,696,467	2.5	59	23,573,317
II(d) Miscellaneous lymphoreticular neoplasms	2.3	11	4,696,467	6.0	143	23,573,317
II(e) Unspecified lymphomas	0.2	1	4,696,467	0.4	10	23,573,317
III CNS and misc intracranial and intraspinal neoplasms	42.3	199	4,696,467	51.5	1,215	23,573,317
III(a) Ependymomas and choroid plexus tumor	3.5	17	4,696,467	4.6	109	23,573,317
III(b) Astrocytomas	18.3	86	4,696,467	17.5	412	23,573,317
III(c) Intracranial and intraspinal embryonal tumors	5.7	27	4,696,467	6.0	143	23,573,317
III(d) Other gliomas	2.6	12	4,696,467	6.4	150	23,573,317
III(e) Other specified intracranial/intraspinal neoplasms	11.6	54	4,696,467	15.9	376	23,573,317
III(f) Unspecified intracranial and intraspinal neoplasms	0.6	3	4,696,467	1.1	25	23,573,317
IV Neuroblastoma and other peripheral nervous cell tumors	9.9	48	4,696,467	8.9	212	23,573,317
IV(a) Neuroblastoma and ganglioneuroblastoma	9.7	47	4,696,467	8.6	204	23,573,317
IV(b) Other peripheral nervous cell tumors	0.2	1	4,696,467	0.3	8	23,573,317
V Retinoblastoma	2.5	12	4,696,467	3.0	71	23,573,317
VI Renal tumors	6.4	31	4,696,467	7.4	175	23,573,317
VI(a) Nephroblastoma and other nonepithelial renal tumors	5.8	28	4,696,467	6.6	157	23,573,317
VI(b) Renal carcinomas	0.7	3	4,696,467	0.8	18	23,573,317
VI(c) Unspecified malignant renal tumors	0.0	0	4,696,467	0.0	0	23,573,317
VII Hepatic tumors	2.3	11	4,696,467	2.9	68	23,573,317
VII(a) Hepatoblastoma	1.4	7	4,696,467	2.1	51	23,573,317
VII(b) Hepatic carcinomas	0.9	4	4,696,467	0.7	17	23,573,317
VII(c) Unspecified malignant hepatic tumors	0.0	0	4,696,467	0.0	0	23,573,317
VIII Malignant bone tumors	8.7	40	4,696,467	10.2	240	23,573,317
VIII(a) Osteosarcomas	5.6	26	4,696,467	5.4	128	23,573,317
VIII(b) Chondrosarcomas	0.0	0	4,696,467	0.3	7	23,573,317
VIII(c) Ewing tumor and related sarcomas of bone	2.4	11	4,696,467	3.8	89	23,573,317
VIII(d) Other specified malignant bone tumors	0.6	3	4,696,467	0.6	13	23,573,317
VIII(e) Unspecified malignant bone tumors	0.0	0	4,696,467	0.1	3	23,573,317
IX Soft tissue and other extraosseous sarcomas	11.3	53	4,696,467	11.8	278	23,573,317
IX(a) Rhabdomyosarcomas	3.6	17	4,696,467	4.1	96	23,573,317
IX(b) Fibrosarcomas, peripheral nerve & other fibrous	1.3	6	4,696,467	1.2	28	23,573,317
IX(c) Kaposi sarcoma	0.0	0	4,696,467	0.0	0	23,573,317
IX(d) Other specified soft tissue sarcomas	4.1	19	4,696,467	5.1	120	23,573,317
IX(e) Unspecified soft tissue sarcomas	2.3	11	4,696,467	1.4	34	23,573,317
X Germ cell & trophoblastic tumors & neoplasms of gonads	12.3	57	4,696,467	14.6	347	23,573,317
X(a) Intracranial & intraspinal germ cell tumors	1.5	7	4,696,467	2.5	59	23,573,317
X(b) Extracranial & extragonadal germ cell tumors	1.5	7	4,696,467	1.8	42	23,573,317
X(c) Malignant gonadal germ cell tumors	8.9	41	4,696,467	9.6	228	23,573,317
X(d) Gonadal carcinomas	0.4	2	4,696,467	0.5	11	23,573,317
X(e) Other and unspecified malignant gonadal tumors	0.0	0	4,696,467	0.3	7	23,573,317

Table 1. Pediatric (Ages 0-19) Cancer Incidence in Idaho and SEER Regions – continued

Site/Type of Cancer	Idaho 2006-2015			SEER 2013-2015		
	Rate	Cases	Pop	Rate	Cases	Pop
XI Other malignant epithelial neoplasms and melanomas	20.2	93	4,696,467	25.9	612	23,573,317
XI(a) Adrenocortical carcinomas	0.0	0	4,696,467	0.2	5	23,573,317
XI(b) Thyroid carcinomas	9.6	44	4,696,467	12.8	304	23,573,317
XI(c) Nasopharyngeal carcinomas	0.0	0	4,696,467	0.4	10	23,573,317
XI(d) Malignant melanomas	6.1	28	4,696,467	5.2	124	23,573,317
XI(e) Skin carcinomas	0.0	0	4,696,467	0.1	2	23,573,317
XI(f) Other and unspecified carcinomas	4.6	21	4,696,467	7.1	167	23,573,317
XII Other and unspecified malignant neoplasms	0.4	2	4,696,467	0.4	10	23,573,317
XII(a) Other specified malignant tumors	0.4	2	4,696,467	0.3	7	23,573,317
XII(b) Other unspecified malignant tumors	0.0	0	4,696,467	0.1	3	23,573,317
Not classified by ICCC or in situ	8.0	37	4,696,467	7.7	182	23,573,317

Rates are per 1,000,000 and age-adjusted to the 2000 U.S. standard.

SEER data are for White race. Cases and rates are for benign, borderline, and malignant behavior.

Statistical Note: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.

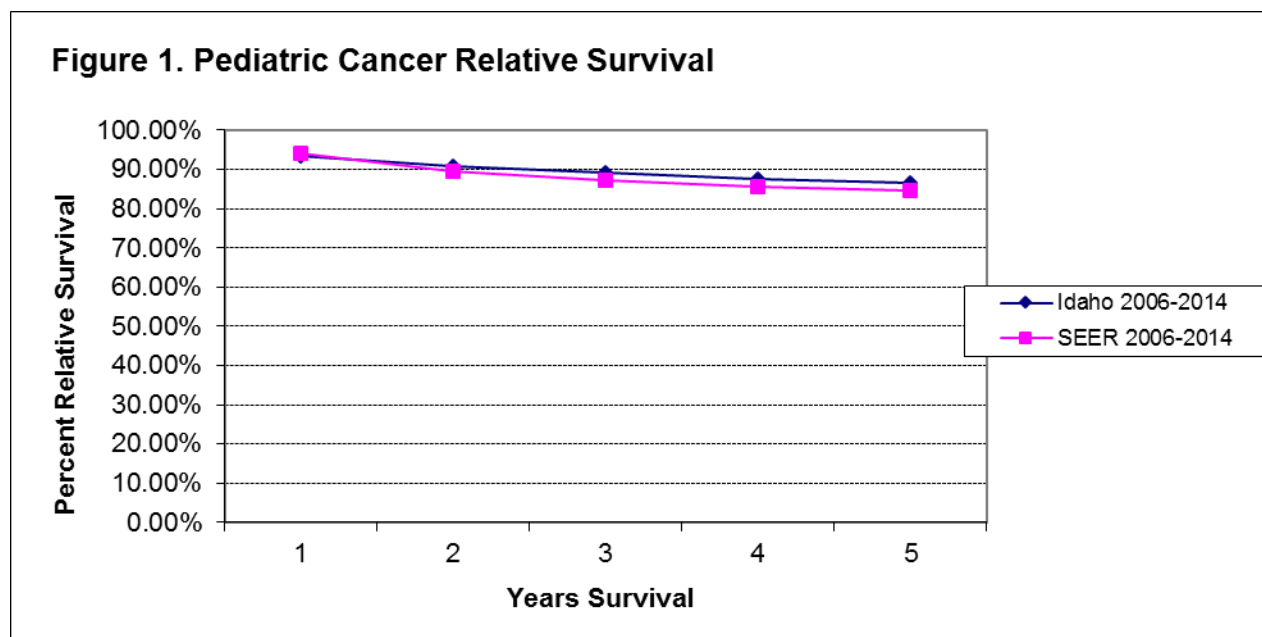


Table 2. Five-Year Relative Cancer Survival by Major ICCC Classification Category

Site/Type of Cancer	Idaho 2006-2014			SEER 2006-2014		
	Cases	% Survival	95% CI	Cases	% Survival	95% CI
All Sites Combined	624	86.5%	83.3% - 89.1%	13,302	84.7%	84.0% - 85.3%
I Leukemias, myeloproliferative & myelodysplastic diseases	113	88.2%	80.4% - 93.1%	3,657	85.2%	83.9% - 86.4%
II Lymphomas and reticuloendothelial neoplasms	87	97.9%	90.8% - 99.5%	1,888	93.4%	92.1% - 94.5%
III CNS and misc intracranial and intraspinal neoplasms	117	82.0%	72.6% - 88.4%	2,230	74.7%	72.7% - 76.6%
IV Neuroblastoma and other peripheral nervous cell tumors	44	84.9%	68.4% - 93.2%	593	81.1%	77.1% - 84.5%
V Retinoblastoma	12	100.6%	+ - +	216	93.9%	88.5% - 96.9%
VI Renal tumors	28	79.0%	55.9% - 90.8%	463	88.0%	84.2% - 91.0%
VII Hepatic tumors	10	60.2%	25.3% - 82.9%	204	74.7%	67.5% - 80.5%
VIII Malignant bone tumors	34	65.9%	46.6% - 79.7%	666	69.3%	65.2% - 73.0%
IX Soft tissue and other extrasosseous sarcomas	48	78.1%	62.8% - 87.7%	855	75.3%	71.9% - 78.3%
X Germ cell & trophoblastic tumors & neoplasms of gonads	49	90.1%	77.3% - 95.9%	993	93.6%	91.8% - 95.1%
XI Other malignant epithelial neoplasms and melanomas	80	94.6%	85.5% - 98.1%	1,509	93.9%	92.4% - 95.1%
XII Other and unspecified malignant neoplasms	2	+	+ - +	28	92.6%	72.8% - 98.2%

+ The statistic could not be calculated.

Table 3. Malignant Pediatric (Ages 0-19) Cancer Incidence in Idaho and SEER Regions.

Year of Diagnosis	Idaho 2006-2015			SEER 2006-2015		
	Rate	Cases	Pop	Rate	Cases	Pop
Total	171.4	806	4,696,467	189.4	15,243	79,950,601
2006	180.0	82	449,429	170.8	1,402	8,130,741
2007	177.9	83	460,456	188.8	1,545	8,099,740
2008	166.5	78	468,822	188.1	1,539	8,093,508
2009	161.5	77	472,822	195.9	1,597	8,075,140
2010	156.6	75	475,169	190.4	1,540	8,032,964
2011	168.8	80	473,773	191.7	1,544	7,996,760
2012	181.1	85	471,778	182.5	1,458	7,948,431
2013	181.2	85	472,075	184.5	1,462	7,904,243
2014	156.5	74	475,027	197.3	1,555	7,857,108
2015	183.0	87	477,116	204.2	1,601	7,811,966

Rates are per 1,000,000 and age-adjusted to the 2000 U.S. standard.

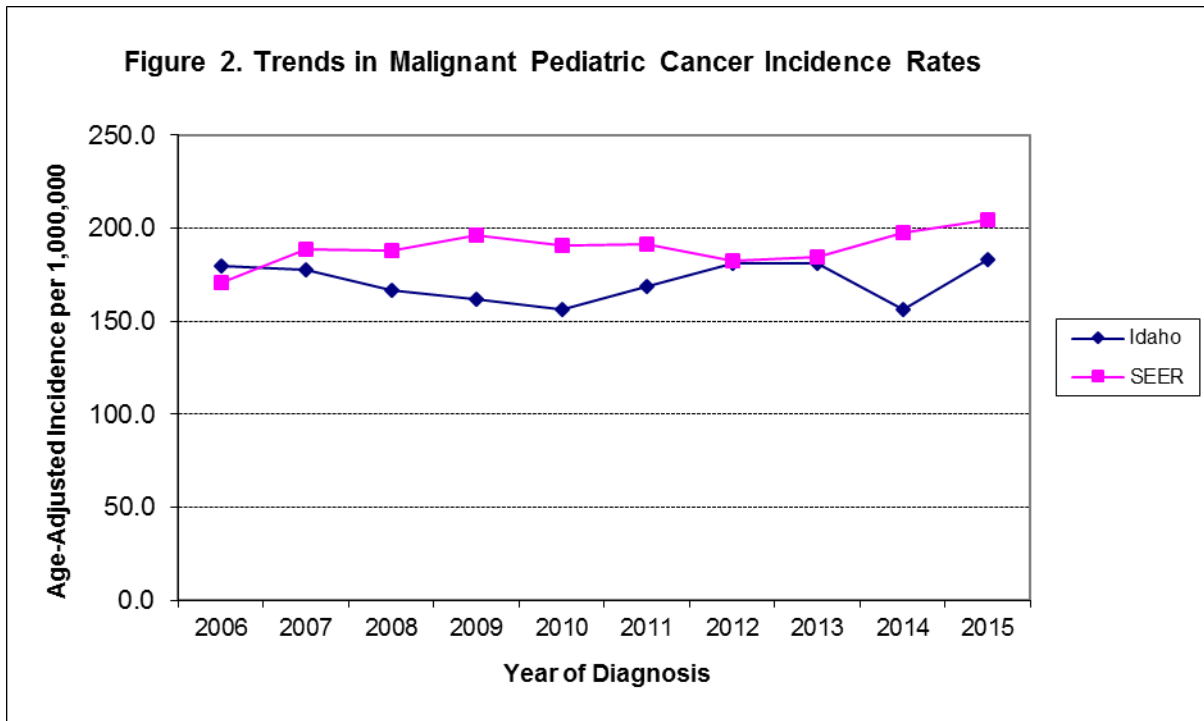


Table 4. Pediatric (Ages 0-19) Cancer Incidence in Idaho by Health District, Major Classification Categories, 2006-2015

Site/Type of Cancer	Health District 1			Health District 2			Health District 3		
	Rate	95% CI	Cases	Rate	95% CI	Cases	Rate	95% CI	Cases
All Sites Combined	182.3	148.4 - 221.5	101	105.8	69.9 - 153.7	28	195.5	166.5 - 228.1	162
I Leukemias, myeloproliferative & myelodysplastic diseases	49.8	32.8 - 72.5	27	20.2	6.5 - 47.4	5	51.7	37.6 - 69.5	44
II Lymphomas and reticuloendothelial neoplasms	28.0	16.0 - 45.6	16	12.6	2.6 - 36.5	3	32.2	21.0 - 47.2	26
III CNS and misc intracranial and intraspinal neoplasms	30.3	17.7 - 48.6	17	36.5	17.3 - 68.2	10	40.9	28.3 - 57.2	34
IV Neuroblastoma and other peripheral nervous cell tumors	13.2	5.3 - 27.1	7	8.3	1.0 - 29.7	2	8.1	3.2 - 16.7	7
V Retinoblastoma	0.0	0.0 - 6.7	0	0.0	0.0 - 14.9	0	3.5	0.7 - 10.4	3
VI Renal tumors	9.3	3.0 - 21.6	5	3.1	0.1 - 19.9	1	8.0	3.2 - 16.6	7
VII Hepatic tumors	9.4	3.1 - 21.8	5	0.0	0.0 - 14.9	0	0.0	0.0 - 4.4	0
VIII Malignant bone tumors	5.4	1.1 - 15.7	3	4.3	0.1 - 23.2	1	8.6	3.5 - 17.7	7
IX Soft tissue and other extraosseous sarcomas	10.7	3.9 - 23.4	6	8.5	1.0 - 30.1	2	3.6	0.7 - 10.4	3
X Germ cell & trophoblastic tumors & neoplasms of gonads	10.5	3.8 - 23.0	6	9.2	1.9 - 29.1	3	21.4	12.5 - 34.2	17
XI Other malignant epithelial neoplasms and melanomas	15.7	7.2 - 30.0	9	3.1	0.1 - 19.9	1	17.5	9.5 - 29.2	14
XII Other and unspecified malignant neoplasms	0.0	0.0 - 6.7	0	0.0	0.0 - 14.9	0	0.0	0.0 - 4.4	0

Site/Type of Cancer	Health District 4			Health District 5			Health District 6			Health District 7		
	Rate	95% CI	Cases	Rate	95% CI	Cases	Rate	95% CI	Cases	Rate	95% CI	Cases
All Sites Combined	217.6	192.4 - 245.2	270	169.9	137.7 - 207.3	97	180.2	146.2 - 219.6	98	169.7	140.3 - 203.4	117
I Leukemias...	59.7	47.0 - 74.9	75	48.2	32.0 - 69.7	28	25.4	13.9 - 42.7	14	40.4	26.8 - 58.4	28
II Lymphomas...	26.2	17.9 - 37.0	32	19.7	9.8 - 35.2	11	15.2	6.6 - 29.9	8	14.6	7.0 - 26.8	10
III CNS and...	38.7	28.6 - 51.2	49	48.7	32.3 - 70.3	28	57.7	39.2 - 81.9	31	44.0	29.6 - 62.8	30
IV Neuroblastoma...	12.7	7.2 - 20.6	16	4.8	1.0 - 14.4	3	14.1	6.1 - 27.9	8	6.7	2.2 - 15.9	5
V Retinoblastoma	1.6	0.2 - 5.8	2	1.6	0.0 - 9.3	1	7.0	1.9 - 18.1	4	2.7	0.3 - 9.9	2
VI Renal tumors	5.5	2.2 - 11.4	7	3.3	0.4 - 12.1	2	6.9	1.9 - 18.0	4	7.1	2.3 - 16.6	5
VII Hepatic tumors	4.0	1.3 - 9.3	5	0.0	0.0 - 6.4	0	0.0	0.0 - 6.8	0	1.6	0.0 - 8.4	1
VIII Malignant bone tumors	9.7	5.0 - 16.9	12	16.2	7.4 - 30.7	9	7.7	2.1 - 19.5	4	6.2	1.7 - 15.5	4
IX Soft tissue...	16.2	9.9 - 25.0	20	3.7	0.5 - 13.2	2	21.3	11.0 - 37.3	12	11.3	4.9 - 22.3	8
X Germ cell...	10.0	5.2 - 17.4	12	7.1	1.9 - 18.2	4	15.4	6.6 - 30.2	8	9.8	3.9 - 20.3	7
XI Other malig epithelial...	33.3	23.8 - 45.4	40	16.5	7.5 - 31.1	9	7.6	2.1 - 19.4	4	23.9	13.7 - 38.7	16
XII Other/unspecified...	0.0	0.0 - 3.0	0	0.0	0.0 - 6.4	0	1.8	0.0 - 10.0	1	1.5	0.0 - 8.1	1

Rates are per 1,000,000 and age-adjusted to the 2000 U.S. standard.

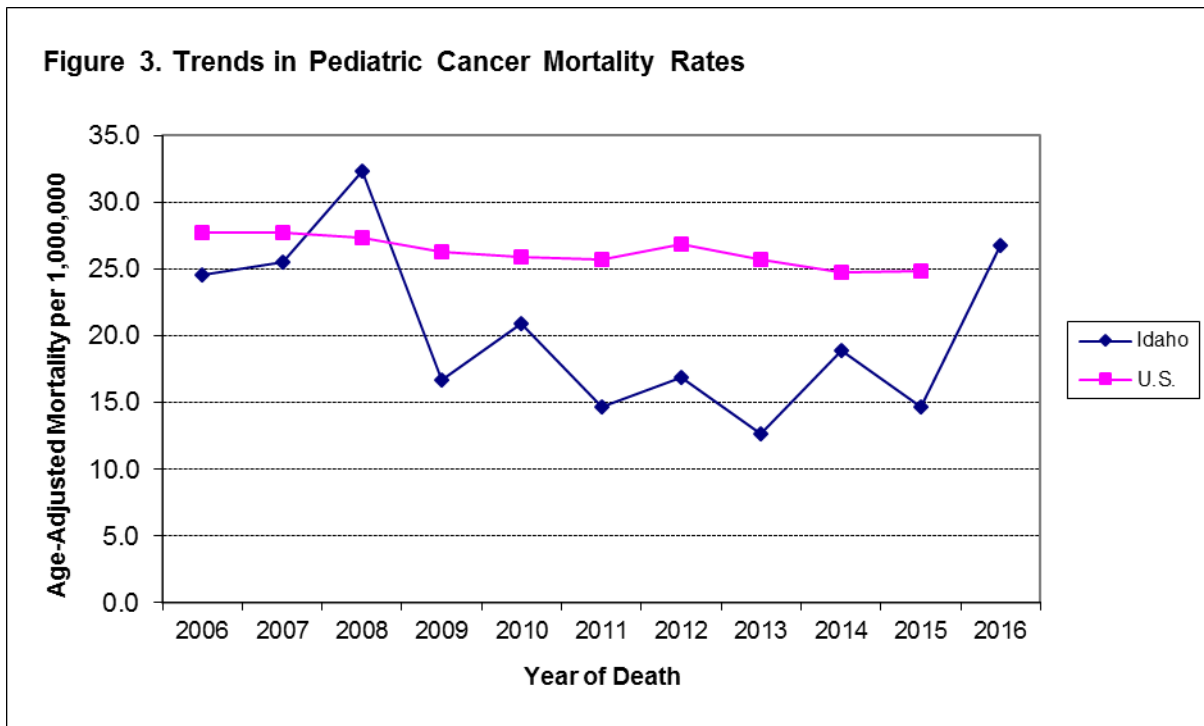
Confidence intervals (CIs) are 95% for rates.

Statistical Note: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.

Table 5. Pediatric (Ages 0-19) Cancer Mortality in Idaho and the U.S.

Year of Death	Idaho 2006-2016			U.S. 2006-2015		
	Rate	Deaths	Pop	Rate	Deaths	Pop
Total	20.5	106	5,178,352	26.3	21,796	826,457,756
2006	24.6	11	449,429	27.7	2,291	82,324,418
2007	25.5	12	460,456	27.7	2,302	82,749,431
2008	32.3	15	468,822	27.4	2,286	83,118,264
2009	16.7	8	472,822	26.3	2,200	83,280,391
2010	20.9	10	475,169	25.9	2,160	83,185,817
2011	14.7	7	473,773	25.7	2,135	82,838,877
2012	16.9	8	471,778	26.9	2,221	82,496,124
2013	12.7	6	472,075	25.7	2,116	82,257,815
2014	18.9	9	475,027	24.8	2,038	82,122,701
2015	14.7	7	477,116	24.9	2,047	82,083,918
2016	26.8	13	481,885			

Rates are per 1,000,000 and age-adjusted to the 2000 U.S. standard.



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- ⁶ Surveillance, Epidemiology, and End Results (SEER) Program (<https://www.seer.cancer.gov/>) SEER*Stat Database: Mortality - All COD, Aggregated With State, Total U.S. (1969-2015) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, released December 2017. Underlying mortality data provided by NCHS (<https://www.cdc.gov/nchs>).
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