

Childhood Cancer in Rhode Island

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ABSTRACT

The incidence rate of childhood cancer is increasing in the United States. We sought to describe the epidemiology of childhood cancer in the state of Rhode Island. Data from the Rhode Island Cancer Registry was reviewed to assess incidence and trends in childhood cancer for individuals age 0–19 years from 1995–2015. Cancer mortality was based on deaths with cause of deaths associated with malignant cancers filed with the Rhode Island Vital Records and CDC National Center for Health Statistics. We found that pediatric cancer is increasing in Rhode Island. Between 1995–2015, there were 1,090 new diagnoses of childhood cancer. Leukemia, tumors of the central nervous system, and lymphomas are the most common types of cancer in children in the state. Additionally, the overall mortality rate from childhood cancer is decreasing. In conclusion, the childhood cancer trends in Rhode Island are consistent with the national data.

KEYWORDS: childhood cancer, pediatrics, malignancy, incidence, mortality

INTRODUCTION

Each year approximately 15,000 children are diagnosed with cancer in the United States, thus it compromises 1% of all cancer diagnoses in the United States. Pediatric cancer is a composed of a heterogenous group of diseases in which each subtype has a unique behavior and biology. This necessitates specific guidelines and recommendations for diagnosing, staging, and treating individuals with pediatric cancer.

Pediatric cancer is the leading disease-related cause of death for children in the United States. It is estimated that 1,800 children die each year.¹ However, over the past fifty years, development of innovative treatments has led to improvements in childhood mortality from malignancy. In the 1970s, only half of all children diagnosed with a pediatric cancer would survive five years from the time of diagnosis. In the current era of treatment, it is estimated that over 80% will be survivors at five years. There is a growing population of pediatric cancer survivors entering adulthood with morbidities directly related to the treatment received decades prior.

Importantly, the rate at which new cases of pediatric cancer are identified is increasing in the United States and in Rhode Island. This report aims to describe the trends in pediatric cancer by age and sex in the state of Rhode Island from 1995–2015.

METHODS

The Rhode Island Cancer Registry (RICR) tracks new cases of pediatric cancer among Rhode Island residents. The diagnoses are classified according to the International Classification of Childhood Cancer (ICCC, ICD-O-3). Data from the Rhode Island Cancer Registry was reviewed to assess incidence and trends in childhood cancer for individuals age 0–19 years from 1995–2015. Cancer mortality was based on deaths with cause of deaths associated with malignant cancers filed with the Rhode Island Vital Records and CDC National Center for Health Statistics.

SEER Stat software v8.3.4 was used to summarize count and age-adjusted rates per 1,000,000 children, using the 2000 US standard population (<http://www.seer.cancer.gov/seestat/index.html>). Overall and grouped ages in years (0–4, 5–9, 10–14, and 15–19 years) was used in direct age standardization. For the trend analysis during the studied period, frequencies, incidence rates, and annual percent were computed and the statistical significance was evaluated for each (p value <0.05).

RESULTS

Between 1995–2015, there were 1,090 new diagnoses of childhood cancer in the state of Rhode Island.

During this time, there was a significant increase of 1.1% in pediatric cancer incidence annually (**Figure 1**). From 1995–2014, there was an increase of 0.8% on average in all childhood cancers nationally. The Rhode Island data aligns with the national trends.

The annual percentage change indicates an upward trend for all age groups. For those age 0–14, this is not statistically significant. However, the increase in childhood cancer in individuals age 15–19 years reaches statistical significance (**Figure 2**).

Leukemia represents 24% of all childhood cancers, the majority of which are acute lymphoblastic lymphomas

Figure 1. Incidence of Childhood Cancer in Rhode Island (1995–2015) and the United States (1995–2014)

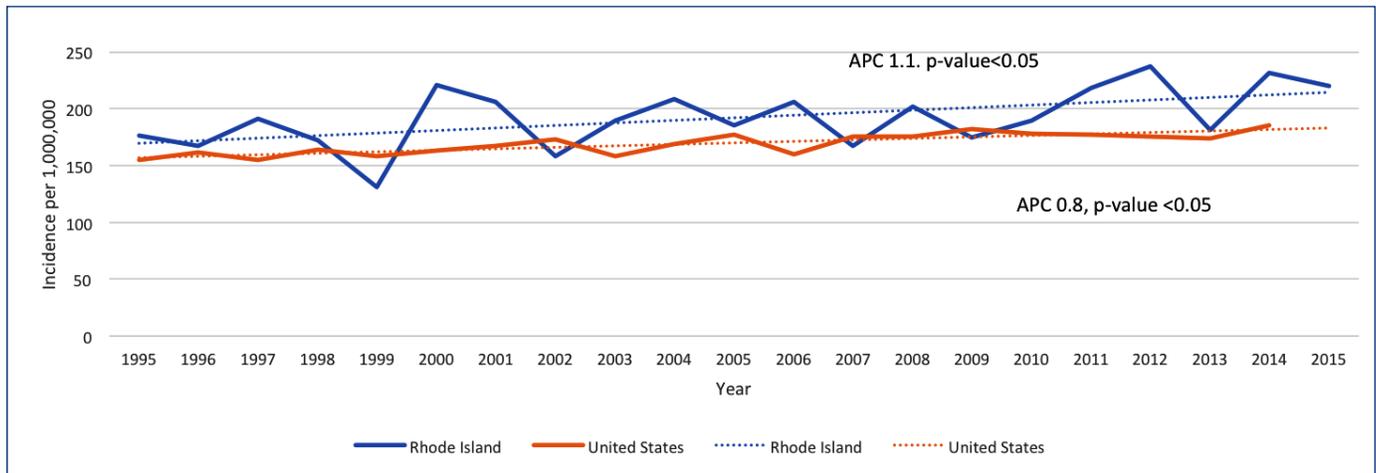
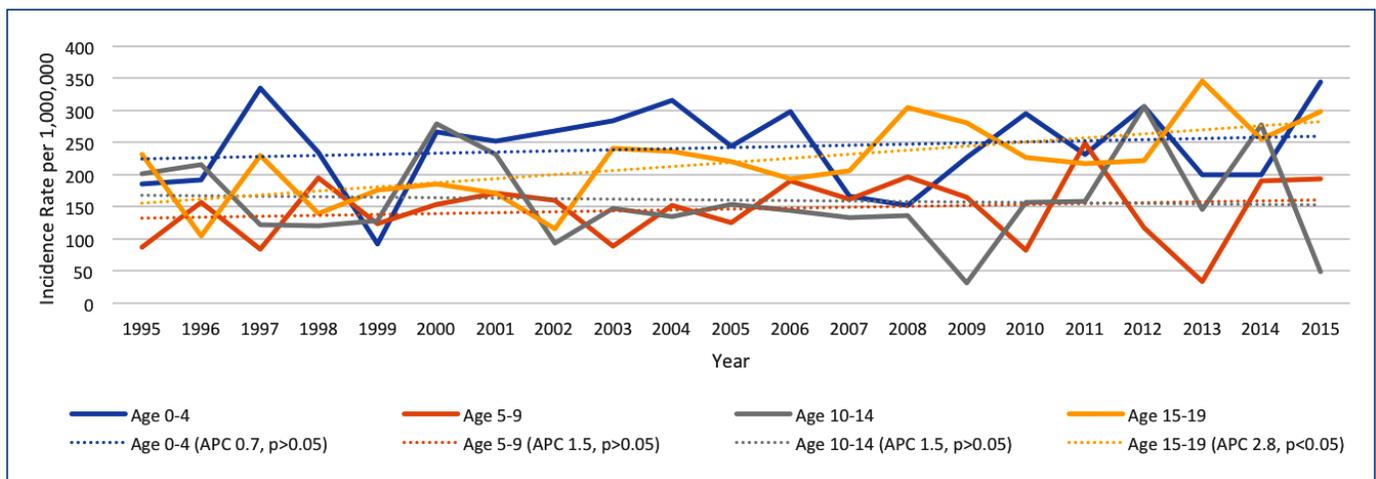


Figure 2. Incidence of Childhood Cancer in Rhode Island by Age, 1995-2015



followed by acute myelogenous leukemias. The second most common pediatric cancer diagnoses are tumors of the central nervous system, which represent 19% of all childhood cancer. Brain tumors are the most common central nervous system tumors, followed by spinal tumors. Lymphomas, which represent 13% of all cancers, include Hodgkin and non-Hodgkin lymphomas with Hodgkin lymphomas being more common. The less common pediatric cancer diagnoses include malignant epithelial tumors, melanomas, germ cell tumors, bone tumors, hepatic tumors, renal tumors, retinoblastoma, and others that cannot be classified (Figure 3).

There is a relationship between cancer subtype and age. Leukemias tend to decrease with age, whereas lymphomas increase with age. These trends are noted in both males and females. Neuroblastoma, kidney tumors, and retinoblastoma are nearly exclusive to younger children. Alternatively, bone tumors are most common in children age 5–9 years. Lymphomas, malignant epithelial tumors, and germ cell tumors frequently occur in older children (Figure 3).

Males and females develop childhood cancer at similar rates. The most common cancers in both males and females are leukemias, central nervous tumors, and lymphomas. Leukemias are more commonly diagnosed in males than females; females have a higher incidence of malignant epithelial neoplasms and melanomas. (Figure 4).

Between 1995–2014, 133 children died of childhood cancer in Rhode Island. The overall mortality rate from childhood cancer is significantly decreasing. National mortality from childhood cancer from 1995-2014 was reduced from 30.2/million (1995–1999) to 15.9/million in 2014 (2000–2014) (Table 1). The 2015 mortality data is not available.

DISCUSSION

The trends of childhood cancer in the state of Rhode Island are similar to the national trends regarding cancer-specific incidence rate and the demographic characteristics associated with cancer subtypes. Leukemia, central nervous

Figure 3. Incidence of Childhood Cancers in Rhode Island by Cancer Type (ICCC) and Age, 1995–2015

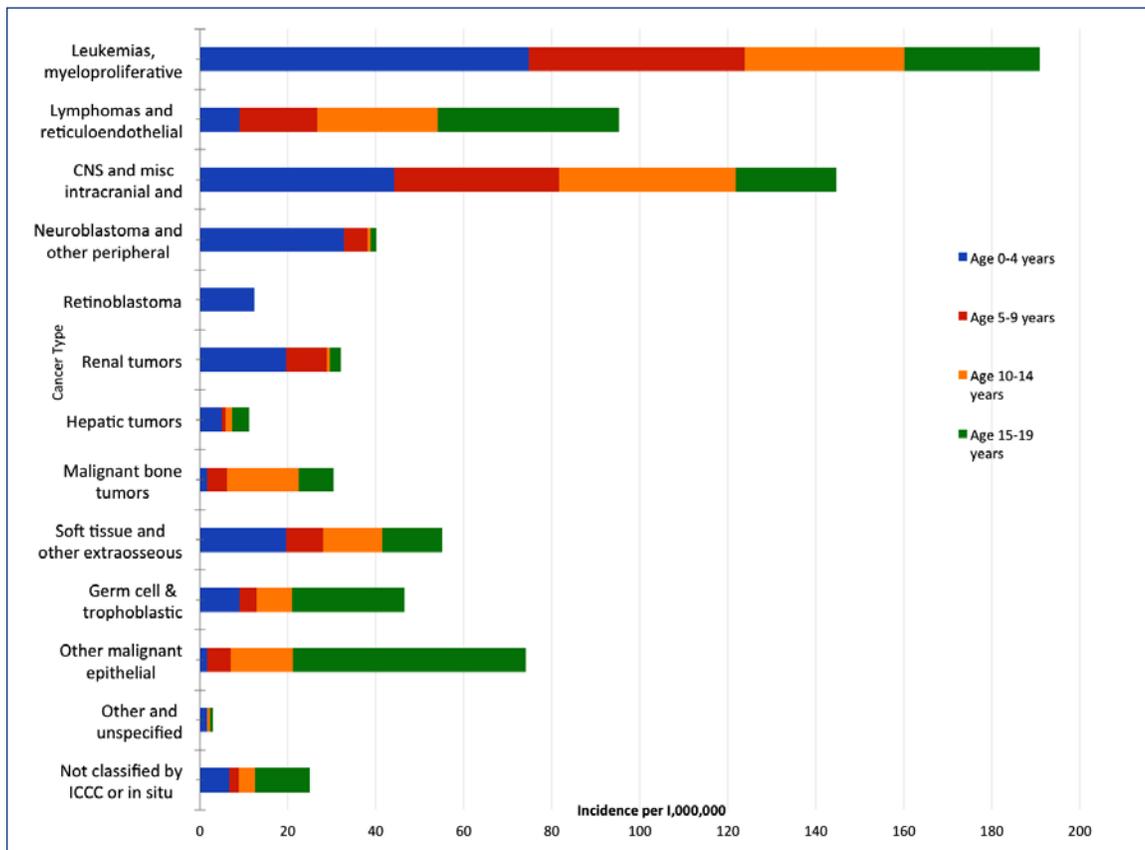


Figure 4. Incidence of Childhood Cancer (ICCC) and Sex, 1995-2015

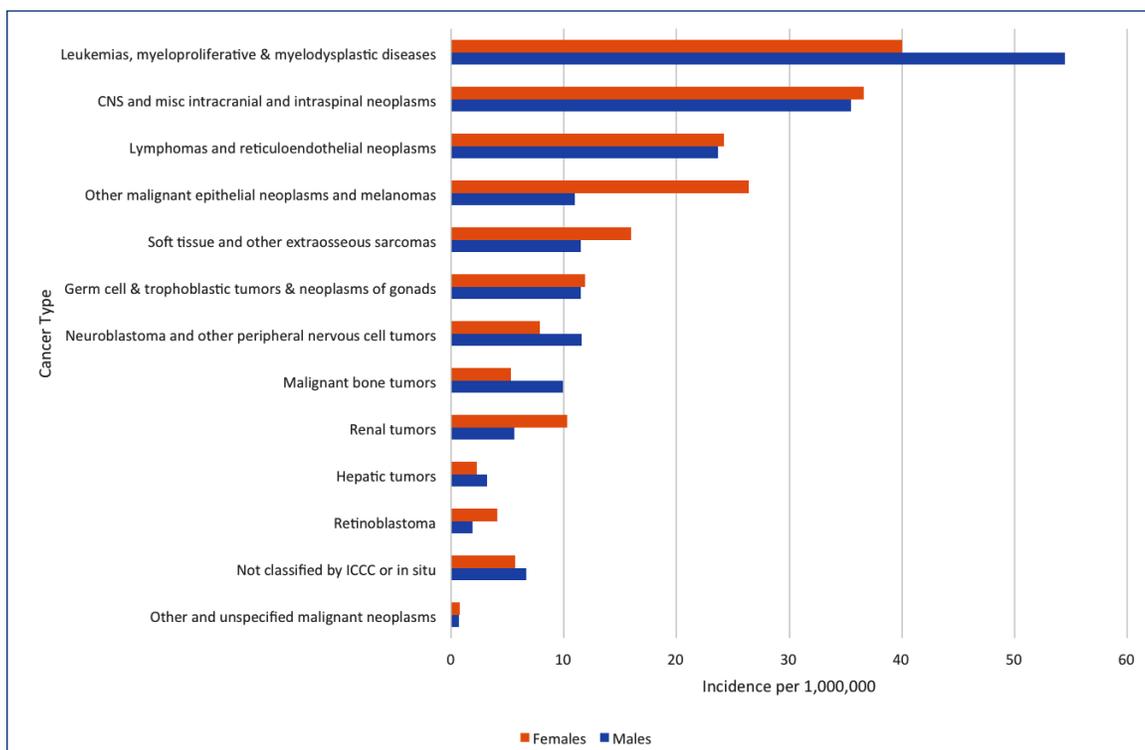


Table 1. Childhood Mortality Rate in Rhode Island and the United States (1995–2014)

Year	Rhode Island			U.S.		
	Count	Rate (per 1000,000)	Rate (per 1,000,000) Confidence Interval	Count	Rate (per 1000,000)	Rate (per 1,000,000) Confidence Interval
1995-1999	41	30.2	21.6-0.9	11,179	28.6	28.0- 29.1
2000-2004	41	29.2	20.9-39.6	11,224	27.6	27.1-28.2
2005-2009	31	22.4	15.2-31.9	10,289	24.8	24.3-25.3
2010-2014	20	15.9	9.7-24.6	9,593	23.2	22.7-23.6
Total	133	24.6	20.6-29.2	42,285	26	25.7-26.2

system tumors, and lymphomas are the three most common cancers of childhood within the state and nationally. The progress towards improved overall survival and decrease in cancer-related mortality in children is appreciated as well.

Unlike many adult malignancies for which lifestyle and environmental risk factors have been well-elucidated, further investigation is needed to understand environmental risk in childhood. The carcinogenic effects of ionizing radiation and chemotherapy in childhood are well-described.² The influence of parental occupations, pesticides, volatile organic compounds, nitrites, and exposure to roadway traffic reveal an association to pediatric cancer.^{3,4} However, findings in other studies do not reveal an association.

A small number of childhood cancers have known genetic causes. Syndromes predisposed to developing a childhood malignancy include, but are not limited to, Down syndrome, neurofibromatosis, Beckwith-Wiedemann syndrome, ataxia-telangiectasia. Guidelines exist for treatment and counseling patients with such genetic conditions. However, for the majority of pediatric cancers, there are not identifiable risk factors. Consequently, there are no developed recommendations for screening children for this rare group of diseases.

Although the causes of most childhood cancers are unknown, the treatment of pediatric cancer has significantly improved over the past five decades. For example, acute lymphoblastic leukemia is no longer regarded as an incurable; today's anticipated overall survival approaches 90%.⁵

As incidence of childhood cancer is increasing and the overall mortality is decreasing, there is a continually growing population of childhood cancer survivors. They face unique challenges as they enter adulthood such as heart disease, infertility, and secondary malignancies. Transition of care from a pediatric to adult care is particularly challenging for the adolescent and young adult population. Many report no mechanism for transition of care from pediatric to adult-focused providers.⁶ In addition to access to care, many survivors enter adulthood with co-morbid conditions related to their treatment. Surveillance and monitoring of the late effects in this group of patients required comprehensive longitudinal care.

References

1. Siegel RL, Miller KD, Jemal A. Cancer Statistics, 2017. *CA: A Cancer Journal for Clinicians* 2017; 67(1):7-30.
2. Kutanzi KR, Lumen A, Koturbash I, Miousse IR. Pediatric Exposures to Ionizing Radiation: Carcinogenic Considerations. Solo-Gabriele H, Ferguson A, eds. *International Journal of Environmental Research and Public Health*. 2016;13(11):1057. doi:10.3390/ijerph13111057.
3. Wigle DT, Turner MC, Krewski D. A systematic review and meta-analysis of childhood leukemia and parental occupational pesticide exposure. *Environ Health Perspect*. 2009;117:1505–1513.
4. Kumar, SV. Maternal Residential Proximity to Major Roadways and Pediatric Embryonal Tumors in Offspring. *International Journal of Environmental Research and Public Health*. 2018;1515(3). doi:10.3390/ijerph15030505.
5. Pui C-H, Yang JJ, Hunger SP, et al. Childhood Acute Lymphoblastic Leukemia: Progress Through Collaboration. *Journal of Clinical Oncology*. 2015;33(27):2938-2948. doi:10.1200/JCO.2014.59.1636.
6. Eshelman-Kent, et al. Cancer survivorship practices, services, and delivery. A report from the Children's Oncology Group (COG) nursing discipline, adolescent/young adult, and late effects committees. *J Cancer Surviv*. 2011;5:345-357.

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