SPECTRUM OF PEDIATRIC CANCER DISEASES AND TREATMENT RESULTS AT PEDIATRIC DEPARTMENT OF VIETNAM NATIONAL CANCER HOSPITAL, CAMPUS 3

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ABSTRACT

Childhood cancer was recognized with high mortality. The aim of this study was to evaluate spectrum of disease and treatment results at Pediatric Department, National Cancer Hospital campus 3 so effective treatment and plans can be developled. A cross-sectional, retrospective study was conducted in 5 years from 2017 – 2021 with 1311 children newly diagnosed in total, predominantly with solid tumors. The median age of the children was 8.2 years (ranging from 10 months to 17 years), with 59% being boys, mainly from the Northern Delta region. The most common cancers were sarcoma, neuroblastoma, osteosarcoma, lymphoma, and retinoblastoma, with rates of 15.5%, 12.4%, 11.9%, 10.4%, and 10.1%, respectively. The rates of mortality, treatment abandonment, and relapse were 26%, 19.6%, and 12.6%, respectively; however, these rates have shown a decreasing trend from 2017 to 2021.

MÔ HÌNH BỆNH TẬT VÀ KẾT QUẢ ĐIỀU TRỊ TẠI KHOA NHI BỆNH VIỆN K – CƠ SỞ TÂN TRIỀU

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TỪ KHÓA

Ung thư trẻ em
U đặc
Mô hình bệnh tật
Kết quả điều trị
Viện K Tân Triều

TÓM TẮT

Ung thư là một trong số các bệnh lý có tỷ lệ tử vong cao ở trẻ em. Mục tiêu của nghiên cứu này đánh giá mô hình bệnh tật và kết quả điều trị tại khoa Nhi, viện K Tân Triều để từ đó có thể xây dựng kế hoạch điều trị và can thiệp hiệu quả. Nghiên cứu cắt ngang, hồi cứu số liệu trong 5 năm từ 2017 – 2021 cho thấy có 1311 trẻ được chẩn đoán mắc mới với ưu thế là các loại u đặc, độ tuổi trung vị của trẻ là 8,2 tuổi (từ 10 tháng – 17 tuổi) với 59% là trẻ nam, chủ yếu là trẻ sống ở khu vực đồng bằng Bắc bộ. Hay gặp nhất là trẻ mắc sarcoma, u nguyên bào thần kinh, u xương, u lympho và u nguyên bào võng mạc với tỷ lệ lần lượt là 15,5%, 12,4%, 11,9%, 10,4% và 10,1%. Tỷ lệ tử vong, bỏ điều trị và tái phát bệnh trung bình tương ứng là 26%, 19,6% và 12,6%, tuy nhiên các tỷ lệ này có xu hướng giảm dần kể từ năm 2017 đến năm 2021.

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1. Introduction

Cancer is recognized as a significant and dangerous non-communicable disease in both adults and children [1]. According to the World Health Organization, approximately 400,000 children aged 0-19 years are diagnosed with cancer annually [2]. The most prevalent cancers in this age group include acute leukemia, brain cancers, lymphomas, and solid tumors such as neuroblastoma and Wilms' tumor [3]. The economic impact of childhood cancer is substantial, as families face considerable financial challenges associated with caregiving and medical expenses, contributing to economic burdens across numerous countries [4].

Survival rates for pediatric cancers vary significantly across different countries. For instance, in high-income countries such as the United States, survival rates reach up to 84.7% in children and 85.9% in adolescents [5], or a population-based study across 31 European countries, involving over 135,000 children, the 5-year disease-free survival rate for children aged 0 to 14 years reached 81% [6]. However, in low- and middle-income countries (LMICs), these rates are markedly lower, ranging from 15-45% [7]. At the National Children's Hospital, approximately 300-350 new cases of childhood cancer are managed annually at the Oncology Department [8]. Unlike adult cancers, childhood cancers are generally not preventable and cannot be detected early through routine screening. Mortality is primarily dependent on the cancer type and stage at diagnosis. Therefore, it is crucial to examine disease patterns at each cancer center to develop tailored treatment strategies. So, what are the most common diagnoses of patients treated at the Pediatric Department, Vietnam National Cancer Hospital, Campus 3? And what are the treatment results for childhood cancer? This study assessed the disease profile and treatment results at the Pediatric Department, National Cancer Hospital Campus 3, the findings aim to enhance resource allocation for treatment and support the development of targeted interventions in the near future.

2. Patients and research method

2.1. Study design

A cross-sectional retrospective descriptive study was performed with newly admitted patients at the Pediatric Department, Vietnam National Cancer Hospital, Campus 3.

2.2. Study duration and location

The study was conducted over a period of 5 years, from January 1, 2017, to December 31, 2021, at the Pediatric Department, Vietnam National Cancer Hospital, Campus 3.

2.3. Study subjects

The criteria for selecting research subjects included newly admitted patients aged 0-18 years receiving treatment at Vietnam National Cancer Hospital, Campus 3. We selected the entire sample size, and the sampling technique involved collecting medical records of the patients. The exclusion criteria were patients without fully collected information. The actual sample size obtained during the study period was 1,311 patients.

2.4. Data collection and processing

This retrospective analytical study collected information about patients, including age, sex, living region, diagnosis, and treatment results such as death, abandonment, or relapse. Excel and SPSS 20.1 software were used to manage and process the data. Variables were expressed in absolute (n) and relative (%). The mean was expressed as M±m if a normal distribution was observed. Variables include age group divided from 1 to 5 in increasing age order, gender (from 1 to 2: Male or Female), abandonment status, relapse, and death outcome as binary variables (0 to 1: No or Yes), year of diagnosis (from 1 to 5, corresponding to the years from 2017 to 2021). The

correlation between variables was determined by a linear function and evaluated using Pearson's correlation coefficient.

2.6. Ethics

The study was conducted following the ethical standards set for descriptive research. Confidentiality of patient data was strictly maintained, and data were anonymized to protect patient identity. The annual number of patients admitted and newly diagnosed in the Pediatrics Department at K Tan Trieu Hospital is illustrated in Figure 1

3. Results

3.1. Annual number of newly admitted children at Pediatric Department, National Cancer Hospital

The annual number of newly diagnosed patients admitted in the Pediatrics Department of National Cancer Hospital Campus 3 was illustrated in Figure 1.

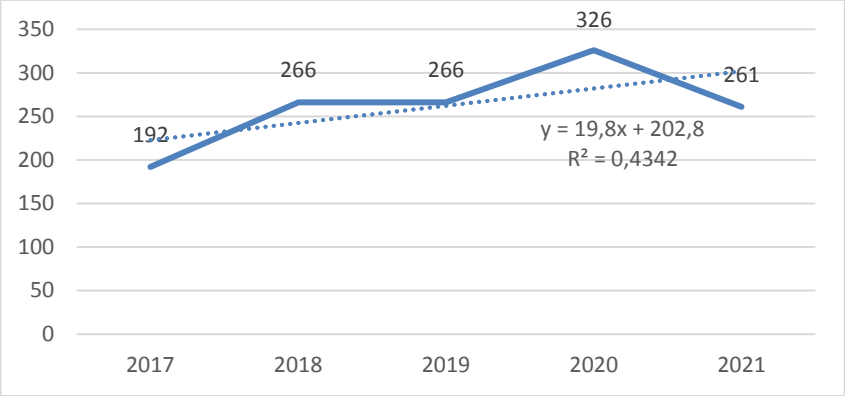

Figure 1. *Annually number of newly admitted children at Pediatric Department, National Cancer Hospital, campus 3 from 2017 to 2021*

Over the 5-year period from January 2017 to December 2021, 1311 pediatric patients newly hospitalized at the Pediatric Department, National Cancer Hospital, campus 3. On average, about 266 pediatric patients were admitted to the hospital each year, following an upward trend. In 2021, there were 261 children hospitalized, approximately 10% fewer than in 2020.

3.2. Epidemiological characteristics of pediatric patients

The median age of children was 8.2 years (ranging from 10 months to 17 years). The characteristics of the participants are shown in Table 1.

Table 1. *Gender and age group characteristics of newly admitted children at the Pediatric Department, National Cancer Hospital, campus 3 from Jan. 2017 to Dec. 2021*

Characteristics	n	%
Gender		
Boys	774	59
Girls	537	41
Total	1311	100
Age group		
< 1 year old	68	5.2
1–5 years old	376	28.7
5–10 years old	357	27.2
10 – 14 years old	321	24.5
14 – 18 years old	189	14.4
Total	**1311**	**100**

The prevalence of boys was higher than that of girls. The lowest age group was infants, followed by the 14-18 years old group (14.4%). The number of children in the 1-5 years old, 5-10 years old, and 10-14 years old groups was relatively even.

Children came to the Pediatric Department, National Cancer Hospital Campus 3 from 41 different provinces and cities across the country. The percentage of children coming to the Pediatric Department, National Cancer Hospital Campus 3 from various provinces, regions, and cities for treatment is shown in Figure 2.

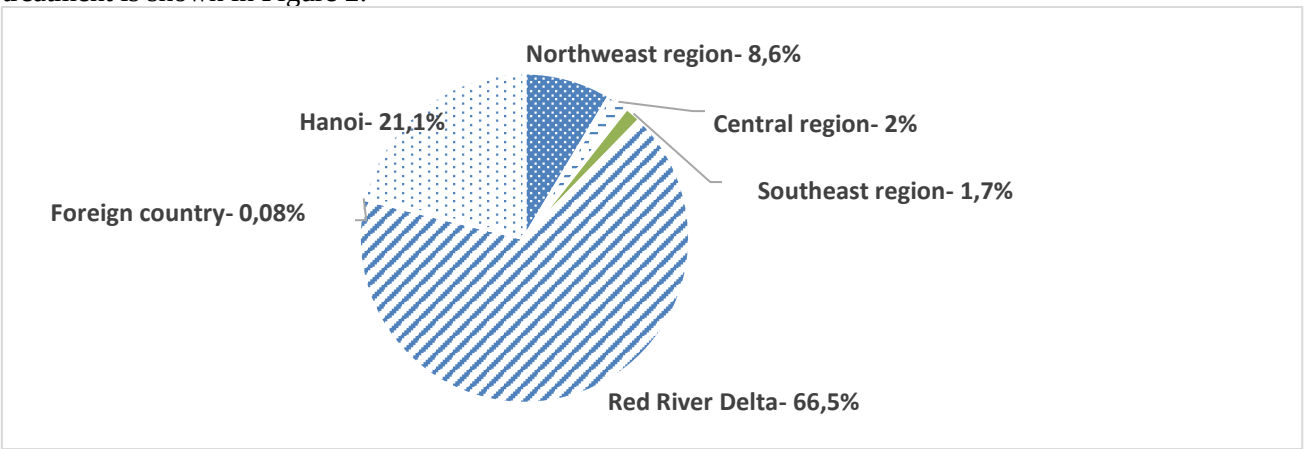

Figure 2. *Percentage of patients coming to the Pediatric Department, National Children Hospital by regions, provinces, and cities*

The highest proportion of patients were from Hanoi (21.1%) and Red River Delta (66.5%). Only 1.7% of children came from southern provinces such as Ho Chi Minh City and Dong Nai.

3.3. Distribution of patients according to the type of diseases diagnosed

The definitive diagnosis of solid tumors was confirmed by histopathological results after biopsy, while hematological malignancies were diagnosed based on bone marrow findings. A total of 1239 pediatric patients underwent biopsies and/or immunohistochemical staining for a definitive diagnosis. Seventy-two children did not receive a biopsy. The distribution of patients according to the type of diagnoses is shown in Figure 3.

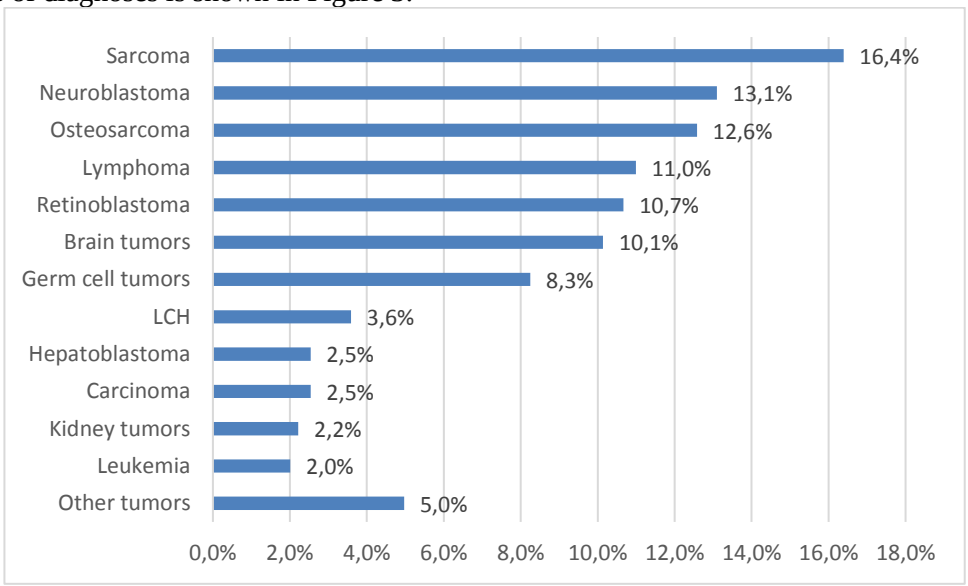

Figure 3. *Distribution of diseases diagnosed at Pediatric Department, National Children Hospital Campus 3 during 5 years from 2017 to 2021*

The predominant diseases diagnosed at the Pediatric Department, National Cancer Hospital Campus 3 were solid tumors, with the rate of acute leukemia in children accounting for only 2%. Among solid tumors, the highest prevalence included sarcoma (including rhabdomyosarcoma, Ewings sarcoma and other type of sarcoma), neuroblastoma, osteosarcoma, lymphoma, retinoblastoma and brain tumours with rates of 16.4%, 13.1%, 12.6%, 11.0%, 10.7% and 10.1%, respectively.

3.4. The treatment results at Pediatric Department, National Children Hospital Campus 3 for 5 years from 2017 to 2021

Several basic indicators were used to evaluate the treatment results of a cancer center, such as mortality and treatment abandonment. These indicators for the Pediatric Department, National Cancer Hospital Campus 3, are illustrated in Table 2.

Table 2. *The mortality, relapse, and abandonment at Pediatric Department National Children Hospital Campus 3*

Indicators	Quantity (n)	Percentage (%)
Death outcome		
Yes	322	26.0
No	754	60.9
Missing	163	13.1
Abandonment		
Yes	226	18.2
No	990	79.9
Missing	23	1.9
Relapse		
Yes	161	13.0
No	818	16.4
Missing	260	21.0
Total	**1239**	**100%**

The mortality consisted of 26%, the prevalence of abandonment and relapse were 19.6% and 12.6%, respectively.

The proportions of different diseases in the total number of patients who abandoned treatment, relapsed, and died was examined in Table 3.

Table 3. *Proportions of different diseases in total abandonment, relapse, and death patients at Pediatric Department National Children Hospital Campus 3*

Type of cancer	Abandonment		Relapse		Death outcome	
	n	Percentage	n	Percentage	n	Percentage
Leukemia	7	3.1%	1	0.6%	5	1.6%
Neuroblastoma	30	18.6%	35	26.1%	46	30.9%
Germ cell tumors	14	14.1%	6	6.7%	21	25.6%
Lymphoma	31	23.1%	7	6.3%	37	31.9%
Kidney tumors	4	14.8%	6	21.5%	11	25.8%
Sarcoma	43	21.8%	37	23.7%	51	27.6%
Hepatoblastoma	9	29%	4	18.2%	9	30%
Osteosarcoma	30	19.9%	26	25.2%	44	34.4%
Retinoblastoma	10	7.8%	15	14%	19	18.5%
Others	13	5.8%	2	1.2%	11	3.4%
Brain tumors	28	22.4%	15	16.3%	34	33%
Carcinoma	3	9.7%	6	20%	5	17.9%
LCH	4	9.1%	1	2.4%	5	2.8%
Total	**226**	**100%**	**161**	**100%**	**322**	**100%**

Different diseases accounted for varying proportions of the total number of children who abandon treatment, relapse, and die. Neuroblastoma, lymphoma, sarcoma, and osteosarcoma

accounted highest proportions in abandonment, relapse, and death outcomes. Leukemia had the lowest proportions in abandonment, relapse, and death, accounted for 3.1%, 0.6% and 1.6%, respectively.

3.5. Correlation between anthropometric factors to treatment outcome in children with cancer at the Pediatric Department - National Children Hospital

Table 4. *Linear correlation between several factors and outcome treatment*

		Age group	Gender	Abadon-ment	Relapse	Death outcome	Year of diagnosis
Age group	Pearson Correlation	1	0.014	0	-0.020	-0.047	0.015
	p		0.614	0.989	0.515	0.141	0.591
Gender	Pearson Correlation	0.014	1	0.004	0.042	-0.002	-0.019
	p	0.614		0.882	0.174	0.939	0.506
Abadonment	Pearson Correlation	0	0.004	1	0.043	0.035	-0.065*
	p	0.989	0.882		0.159	0.279	0.024
Death outcome	Pearson Correlation	-0.020	0.042	0.043	1	0.023	-0.106**
	p	0.515	0.174	0.159		0.494	<0,001
Relapse	Pearson Correlation	-0.047	-0.002	0.035	0.023	1	-0.155**
	p	0.141	0.939	0.279	0.494		<0.001
Year of diagnosis	Pearson Correlation	0.015	-0.019	-0.065*	-.106**	-0.155**	1
	p	0.591	0.506	0.024	<0.001	<0.001	

**. The correlation value was significant at 0.05 (from both sides)*
***. The correlation value was significant 0.01 (from both sides)*

The correlation between the abandonment, the mortality and the relapse with the year of diagnosis was recorded. This was an inverse correlation with $r < 0$, meaning that, the mortality, treatment abandonment, and relapse prevalence over the years from 2017–2021 tend to decrease. The gender and age group were not relevant, and not associated with indicators such as mortality, relapse, and treatment abandonment.

4. Discussion

The number of newly admitted children at the Pediatric Department, National Cancer Hospital, tended to increase gradually over the past 5 years. In 2020, the number of hospitalized children increased by about 20% compared to previous years. However, in 2021, the number of hospitalized patients was statistically lower due to a 2-month closure of the National Cancer Hospital, campus 3 for disinfection related to a COVID-19 cluster. Following the trend of increasing hospitalizations, it can be forecasted that the number of pediatric patients admitted for treatment will continue to rise in the next 5 years, according to the formula $y=19.8x+202.8y = 19.8x + 202.8$ with $R^2 = 0.4342$, where y represents the number of newly diagnosed patients annually and x represented the code of the year (for example, for 2022, x=6; for 2023, x=7, etc.). This formula can help estimate near-future hospital admissions and set out appropriate management and treatment plans.

Compared with developed countries, a study in Denmark from 1985 to 2016 recorded 4944 children under 15 years of age with cancer (equivalent to 15.5 to 22.2 cases per 100,000 children) [9]. The prevalence of new cancer cases in Vietnam is relatively high. The number of pediatric patients hospitalized at the Pediatric Department, National Cancer Hospital Campus 3, including benign conditions such as LCH, was lower than the number at the Oncology Department, National Children's Hospital, which recorded 332-345 cases per year [10]. Hospitalized children came from 41 provinces and cities (2/3 of the provinces and cities nationwide), with the highest proportion

from Hanoi (21.1%) and the Northern Delta provinces (66.5%). The Pediatric Department at National Cancer Hospital, campus 3 is one of the largest and most prestigious cancer treatment centers, serving mainly children from the North-Central region. Children treated at National Cancer Hospital, campus 3 were predominantly aged 1-15 years, with the median age of 8.2 years old (ranging from 10 months – 17 years old). The rate of male children was 59%, significantly higher than that of female children. Research in China also showed a predominance of male sex in childhood cancers [11]. Sex differences in cancer incidence may be related to genetic information and developmental processes.

The Pediatric Department of National Cancer Hospital, campus 3 mainly treated solid tumors, with leukemia accounting for only 2% of cases. The disease pattern at the Pediatric Department, National Cancer Hospital, campus 3, was different from other major cancer centers. For example, a 2019 study at the National Children's Hospital Oncology Center reported that leukemia accounted for 35.9% of cases, while 64.1% were solid tumors [12]. According to Nguyen Hoai Anh's statistics from 2008-2014, 47.9% of pediatric patients had acute leukemia [10]. Acute leukemia, including AML, in northern children is mainly treated at the National Institute of Hematology and Blood Transfusion due to blood transfusion needs. National Cancer Hospital, campus 3, with its advantages in chemotherapy and radiation, is the preferred choice for children with solid tumors.

Malignant neoplasms seen in pediatric patients treated at the Pediatric Department of National Cancer Hospital, campus 3 varied in type and lesion location. The two groups with the highest prevalence were sarcoma and neuroblastoma, at 16.4% and 13.1%, respectively. The prevalence of neuroblastoma was similar to that at the National Children's Hospital (14.2%) [10], which is also considered the most common extracranial solid tumor in children according to Katherine Matthay's research [13]. However, the prevalence of other solid tumors such as sarcoma, lymphoma, and germ cell tumors at the Pediatric Department, National Cancer Hospital, campus 3, was higher than that at the Oncology Center, National Hospital of Pediatrics. The disease structure identified in this study can assist healthcare providers in management planning.

The prevalence of treatment abandonment among children treated at the Pediatric Department of National Cancer Hospital, campus 3 was 26%, lower than the 35.2% reported at the National Children's Hospital in 2008-2009. At that time, advanced treatment techniques were not available, and parents often perceived a poor prognosis for their children, leading to financial constraints. The relapse and mortality rates remained relatively high. Among the patients who abandoned, relapsed and died, the proportions of osteosarcomas, brain tumors, and lymphomas were significant, indicating that the management and treatment of these diseases still face many challenges. In contrast, in developed countries, the management of these diseases tends to be better. For example, the mortality rate for osteoblastoma in the US is about 4.2% [8], and in Italy, the 5-year disease-free survival rate for lymphomas ranges from 70-93% depending on the type [9]. These treatment results reflect the limited resources for cancer treatment in a developing country like Vietnam, highlighting the need for further improvement in the quality of treatment for pediatric solid tumors.

Table 4 showed an inverse correlation over the years from 2017 to 2021 with the rates of abandonment, relapse, and death, while Figure 1 recorded an increasing trend in the number of newly diagnosed pediatric patients at the Pediatric Department, National Cancer Hospital, Campus 3. Therefore, it can be considered that the treatment outcomes for newly diagnosed patients are showing an improving trend.

Although this study evaluated the spectrum of disease over a 5-year period from 2017 to 2021 and some treatment results but the follow-up period was short, and a relatively significant amount of data related to relapse and mortality was missing. There was not enough follow-up time for all patients to provide 3-year and 5-year disease-free survival rates or overall survival rates. Therefore, longer studies with sufficient follow-up time are needed to fully clarify the treatment outcomes for pediatric cancer patients treated at National Cancer Hospital, campus 3.

5. Conclusion

During the 5-year period from January 1, 2017 to December 31, 2021, the number of patients admitted to the Pediatric Department, National Children Hospital Campus tended to increase. The average age of children was 8.0±4.9 years old with dominating of group children aged 6 - 10 years old, suffering from solid tumors. The average percentage of treatment abandonment, relapse and mortality were still high, but tended to decrease gradually after 5 years.

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TÀI LIỆU THAM KHẢO/ REFERENCES

[1] F. Bray, M. Laversanne, H. Sung, *et al.*, "Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries," *CA Cancer J Clin.*, vol. 74, no. 3, pp. 229-263, 2024, doi: 10.3322/caac.21834.

[2] C. G. Lam, E. H. Bouffet, and K. Pritchard-Jones, "Science and health for all children with cancer," *Science*, vol. 363(6432), pp. 1182-1186, 2019, doi: 10.1126/science.aaw4892.

[3] World Health Organization, "CureAll framework: WHO global initiative for childhood cancer: increasing access, advancing quality, saving lives," 2021. [Online]. Available: https://apps.who.int/iris/handle/10665/347370. [Assessed May 15, 2024].

[4] A. Alzehr, C. Hulme, A. Spencer, and S. Morgan-Trimmer, "The economic impact of cancer diagnosis to individuals and their families: a systematic review," *Support Care Cancer*, vol. 30, no. 8, pp. 6385-6404, 2022, doi: 10.1007/s00520-022-06913-x.

[5] American Cancer Society, *Key Statistics for Childhood Cancers*, American Cancer Society, 2024.

[6] L. Botta, G. Gatta, R. Capocaccia, *et al.*, "Long-term survival and cure fraction estimates for childhood cancer in Europe (EUROCARE-6): results from a population-based study," *Lancet Oncol.*, vol. 23, no. 12, pp. 1525-1536, 2022, doi: 10.1016/S1470-2045(22)00637-4.

[7] WHO, "Global Initiative for Childhood Cancer," St. Jude Children's Research Hospital, 2018. [Online]. Available: https://www.stjude.org. [Accessed May 27, 2024].

[8] B. N. Lan, A. Castor, T. Wiebe, J. Toporski, C. Moëll, and L. Hagander, "Adherence to childhood cancer treatment: a prospective cohort study from Northern Vietnam," *BMJ Open*, vol. 9, no. 8, 2019, Art. no. e026863, doi: 10.1136/bmjopen-2018-026863.

[9] H. Schrøder, C. Rechnitzer, P. S. Wehner, *et al.*, "Danish Childhood Cancer Registry," *Clin Epidemiol.*, vol. 8, pp. 461-464, 2016, doi: 10.2147/CLEP.S99508.

[10] H. A. Nguyen, N. L. Bui, and T. T. Nguyen, "Childhood cancer incidence and time trends in National Hospital of Pediatrics (NHP) Vietnam from 2008 to 2014," Abstract at the 10th St Jude VIVA forum in Peadiatric Oncology, Singapore from 5 to 6 March 2016.

[11] X. Jiang, S. Cai, Y. Hu, *et al.*, "Sex disparities in cancer incidence in Jiashan County, China, 1995-2014," *Cancer Epidemiol.*, vol. 50(Pt A), pp. 46-52, 2017, doi:10.1016/j.canep.2017.07.013.

[12] N. L. Bui, T. L. Vu, and T. T. D. Le, "Nutritional status of children under 5 years of age with new cancer at National Children's hospital," *Journal of Clinical Medicine*, no. 56/2019, pp. 25-30, 2019.

[13] K. K. Matthay, J. M. Maris, G. Schleiermacher, *et al.*, "Neuroblastoma," *Nat Rev Dis Primers*, vol. 2, 2016, Art. no. 16078, doi: 10.1038/nrdp.2016.78.

[14] S. Smeland, S. S. Bielack, J. Whelan, *et al.*, "Survival and prognosis with osteosarcoma: outcomes in more than 2000 patients in the EURAMOS-1 (European and American Osteosarcoma Study) cohort," *Eur J Cancer*, vol. 109, pp. 36-50, 2019, doi: 10.1016/j.ejca.2018.11.027.

[15] S. Cortelazzo, M. Ponzoni, A. J. Ferreri, and D. Hoelzer, "Lymphoblastic lymphoma," *Crit Rev Oncol Hematol*, vol. 79, no. 3, pp. 330-343, 2011, doi: 10.1016/j.critrevonc.2010.12.003.