

LETTER

Childhood cancer incidence and survival in the Faroe Islands, 1960 to 2019

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ABSTRACT

Background and purpose: This study is the first report regarding childhood cancer in the Faroe Islands and describes the incidence and survival of childhood cancer over the last 60 years in the Faroe Islands.

Material and methods: We included all Faroese children registered with a cancer diagnosis up to the age of 19 years in the Faroese Cancer Registry from 1960 to 2019 and in the Danish Childhood Cancer Registry from 1985 to 2019 in this study. We report the number of incident cancers classified according to the 12 main diagnostic groups in the International Classification of Childhood Cancer, third edition (ICCC-3), but due to small numbers some groups have been combined in the results shown. We report age-standardized incidence rates (world standard population) (ASIR). We also show all-cause survival by incidence stratified by 20-year periods.

Results: There were 114 childhood cancers in the Faroe Islands from 1960 to 2019, corresponding to an ASIR of 13.0 per 100,000 person-years. The most common cancer groups in Faroese children were brain and spinal tumors, followed by leukemias and lymphomas. All-cause survival improved for children diagnosed over time, with a 5-year survival of 43.5% for those diagnosed from 1960 to 1979 and 85.6% for children diagnosed from 2000 to 2019.

Conclusion: Childhood cancer in the Faroes was slightly rarer than in most other high-income countries. Brain and spinal tumors were the most common cancer group in Faroese children. Survival for Faroese children with cancer has improved substantially in the study period.

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Introduction

Childhood cancers are rare, potentially life-threatening diseases with far-reaching consequences for the child and the family affected. Treatment for childhood cancer has improved substantially over the last 50 years [1]. Some cancers that previously had a very low survival have seen marked improvements, which means that today, the vast majority of children diagnosed with cancer will survive [2].

The Faroe Islands are a group of 18 islands in the Atlantic Ocean. The population consists of 53,882 individuals, of which 14,822 are below the age of 20 (2022). The Faroe Islands are a high-income country with a modern healthcare system [3]. However, for childhood cancers, the treatment is delivered in Denmark due to the need for highly specialized treatment, which is impossible to manage locally with approximately two incident cases per year.

Treatment for childhood cancer varies, with detailed protocols for each different type of cancer. The most common

treatments are chemotherapy, and surgery while other options for some cancer types include irradiation and bone marrow transplants [1, 4].

All Faroese children with suspected cancer are sent to Denmark for specific diagnosis and treatment when relevant. Upon verification of the diagnosis, the children undergo an often lengthy stay in Denmark to receive the treatment needed, ranging from a couple of weeks for low-grade tumors removed surgically over 3 to 6 months for lymphoma up to 2.5 years for acute lymphatic leukemia (ALL). In some cases, patients can receive parts of the follow-up treatment in the Faroe Islands, mainly for children who undergo the 2.5 years regime for ALL.

For the first time in the Faroe Islands, we report on the incidence and survival of childhood cancer in Faroese children up to the age of 19 from 1960 to 2020, filling a gap in research about children in the Faroe Islands.

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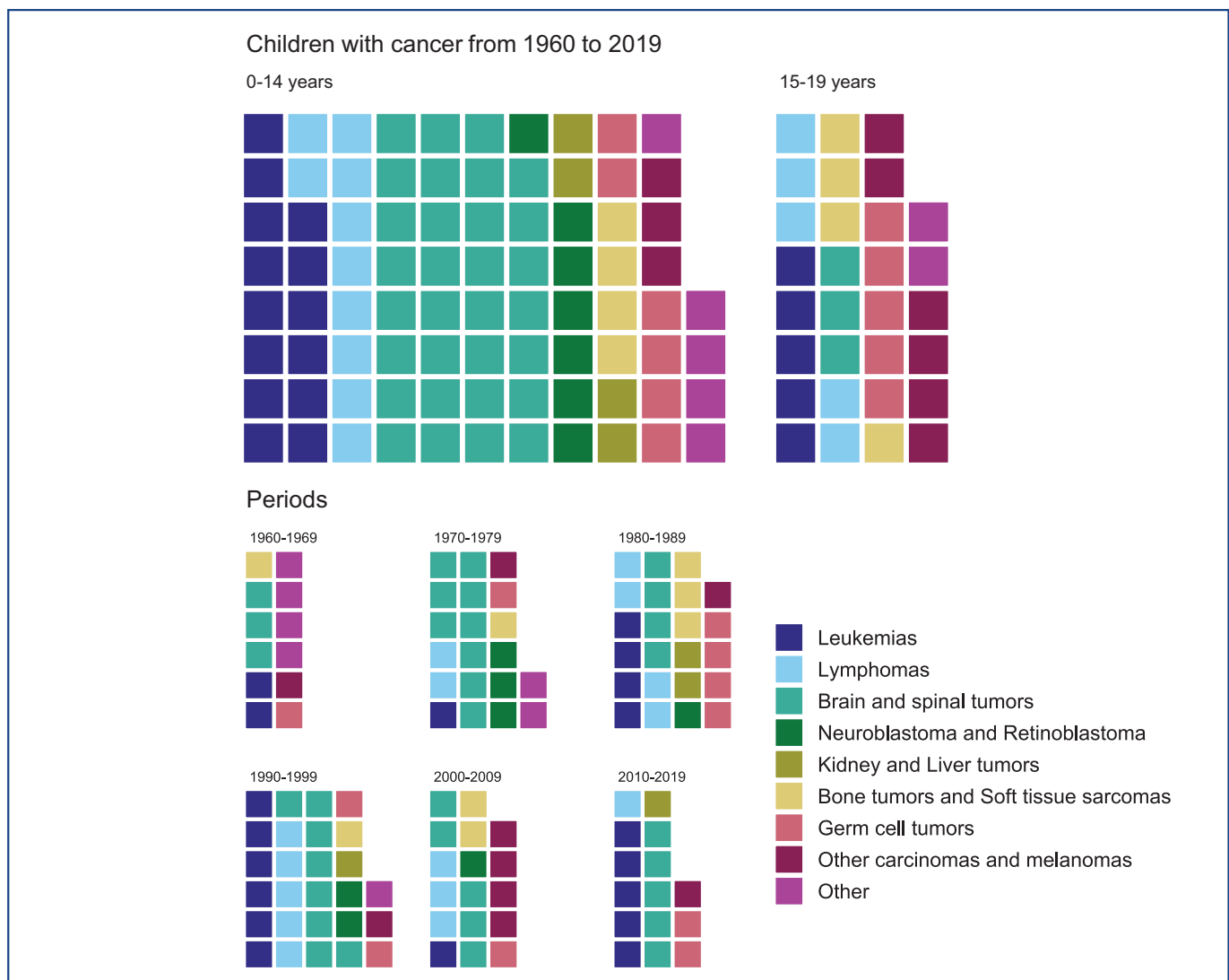


Figure 1. Childhood cancer (≤ 19 years) in the Faroe Islands from 1960 to 2019 by ICCC-3 main diagnostic group.

Waffle plots showing the distribution of ICCC-3 main diagnostic groups in children diagnosed with cancer in the Faroe Islands. Due to small numbers some groups have been combined. Each square represents one cancer case. The upper panel shows the distribution of cancers in girls and boys by children aged 0–14 and 15–19 diagnosed from 1960 to 2019. The lower panel shows the distribution of cancers in both girls and boys for each 10-year period from 1960 to 2019. ICCC-3: International Classification of Childhood Cancer, third edition.

Methods and materials

All cancers in the Faroe Islands are registered in the Faroese Cancer Registry (FCR) [3]. Here, we include all individuals diagnosed with cancer up to the age of 19 in the FCR. However, as all treatment and diagnosis of childhood cancers are performed in Denmark, some cancers might not be registered in the FCR. Therefore, we also included Faroese children reported to the Danish Childhood Cancer Registry (DCCR) [5]. We used billing information present in the Faroese Hospital system to link the Faroese personal identifier with the one used in the danish medical journal.

We classified the cancers according to the 12 main diagnostic groups in the International Classification of Childhood Cancer, third edition (ICCC-3) [6], which are the following: leukemias, lymphomas, brain and spinal tumors, neuroblastoma, retinoblastoma, kidney tumors, liver tumors, bone tumors, soft tissue sarcomas, germ cell

tumors, other carcinomas and melanomas, and other. Due to small numbers, we combined the following diagnostic groups in the results shown: neuroblastomas and retinoblastomas, kidney tumors and liver tumors, and bone tumors and soft tissue sarcomas.

We calculated age-standardized incidence rates (ASIR) using the World standard weights stratified by 10-year periods, 1960 to 1969, 1970 to 1979, 1980 to 1989, 1990 to 1999, 2000 to 2009, and 2010 to 2019. We furthermore compared the Faroese incidence specifically for the two largest cancer groups (leukemias and brain and spinal tumors) to the incidence in Sweden, by calculating the incidence rate ratio (IRR) with corresponding 95% confidence intervals for the age group 0–19 years. We chose to compare with Sweden, as all of the needed numbers were readily available for the period 1984–2010 for the age group 0–19 years in the appendix for a report published by the Swedish Childhood Cancer Registry [7].

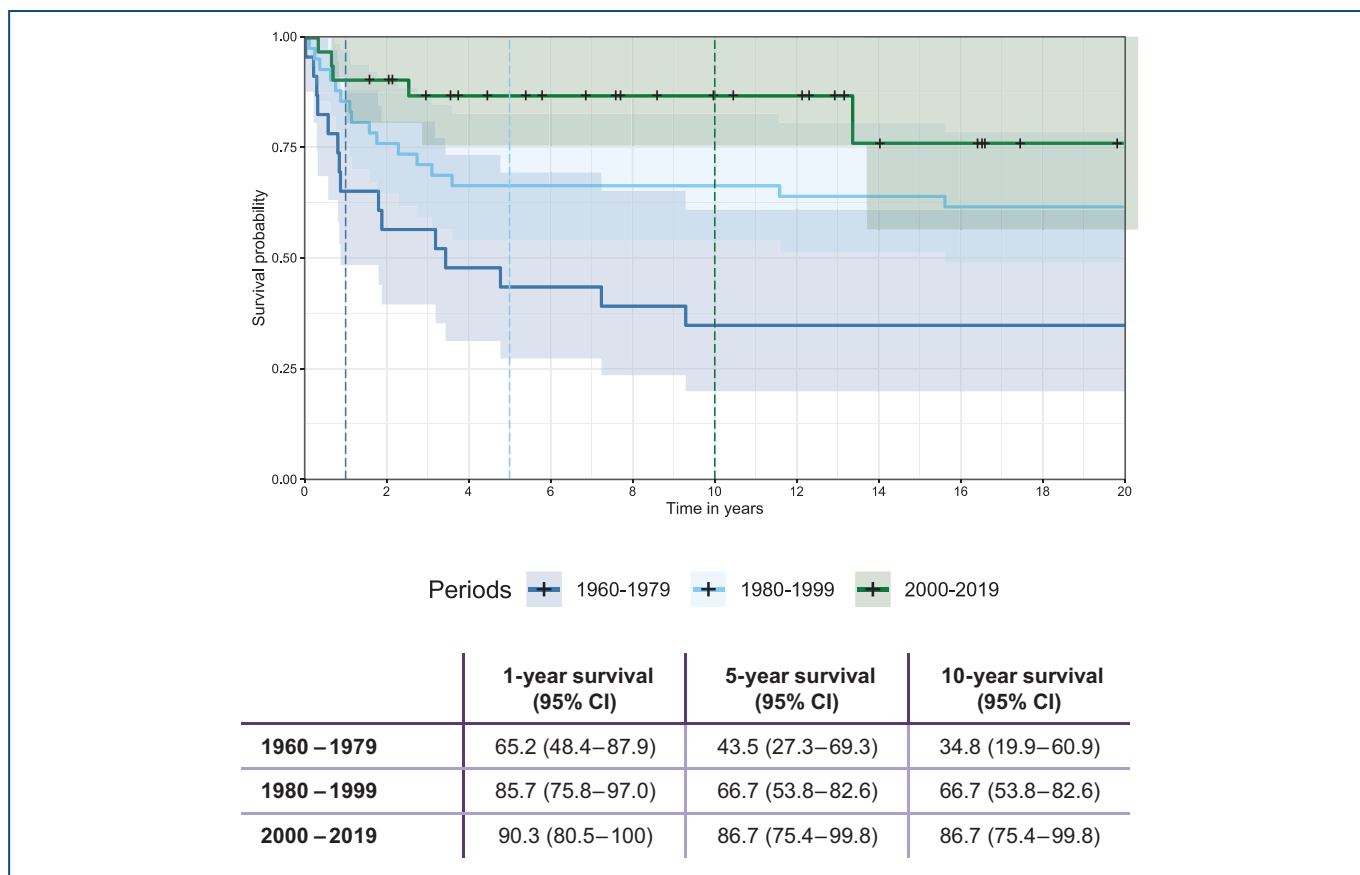


Figure 2. All-cause survival by period in Faroese children with cancer. Kaplan Meier plot showing all-cause survival for Faroese children diagnosed with cancer, stratified by 20-year periods for the time of diagnosis. We excluded children who had a follow-up time of 0 days from the survival analysis (n = 4 for 1960–1979; n = 10 for 1980–1999; n = 3 for 2000–2019). The vertical lines in the graph represent 1-, 5- and 10-year survival, with the corresponding values shown below the graph.

We used R version 4.02 to produce the graphs and the R package Survminer version 0.4.9 [8] to produce Kaplan Meier estimates for all-cause survival for all cancers. For the survival analysis, we grouped patients by the time of diagnosis, 1960 to 1979, 1980 to 1999, and 2000 to 2019, and we excluded cases with a follow-up time of 0 days (n = 4 for 1960–1979; n = 10 for 1980–1999; n = 3 for 2000–2019).

The use of cancer registry data for this project was approved by the Faroese Data Protection Authority (J.nr: 19/00027-4).

Results

Over the last 60 years, 114 Faroese children have been diagnosed with cancer, 50 girls and 64 boys (Figure 1). This corresponds to about two children diagnosed with cancer every year and an ASIR for cancer of any type of 13.0 per 100,000 person-years (pyrs) for the whole period. We identified 28 cases from the DCCR in the period 1985 to 2019, two of which were not registered previously in the FCR. Within the same period and age group (up to 19), there were 70 childhood cancers reported in the FCR. The cancer incidence for boys and girls at different periods and age groups is shown in Table 1. The most common cancer type was brain and spinal tumors, with an ASIR of 3.9 per 100,000 pyrs, followed by leukemias with an ASIR of 2.3 per

100,000 pyrs. Comparing the most common cancer types with the incidence in Sweden from 1984 to 2010, we calculated the IRR of leukemias at 0.52 (95% CI 0.33–0.82) while the IRR of brain and spinal tumors was 1.00 (95% CI 0.71–1.40).

All-cause survival has improved over the years, with 1-year survival improving from 65.2% from 1960 to 1979 up to 90.3% from 2000 to 2019. Five-year survival improved from 43.5% to 86.7% in the same period (Figure 2).

Discussion

Over the last 60 years, just under two Faroese children have received a cancer diagnosis each year on average. Leukemias are the most common childhood cancer group worldwide, followed by brain and spinal tumors and lymphomas [4, 9]. However, this differed slightly for Faroese children, with the most common diagnostic group being brain and spinal tumors, followed by leukemias and lymphomas. The incidence of leukemias was almost half of the incidence in Sweden with an IRR of 0.52, while the incidence of brain and spinal tumors was very similar with an IRR of 1.00.

In a study published in The Lancet Oncology in 2017 [9], the authors compared ASIR from 152 registries in 62 different countries from 2001 to 2010. The ASIR for all cancers for

Table 1. Childhood cancer (≤ 19 years) by sex, period, age group, and diagnostic group in the Faroe Islands from 1960 to 2019 with comparisons to other countries.

	Cases (N)	Crude rate per 100,000			ASIR per 100,000 (W)*
Overall	114	12.66			13.03
Girls	50	11.48			11.94
Boys	64	13.76			14.04
Time period					
1960–1969	12	8.00			7.99
1970–1979	20	12.47			12.97
1980–1989	23	14.45			14.28
1990–1999	27	18.59			19.45
2000–2009	17	11.64			11.36
2010–2019	15	10.71			12.23
Age group					
0–4 year	40	17.86			5.36
5–9 years	24	10.63			2.66
10–14 years	20	8.68			1.95
15–19 years	30	13.59			3.06
Main diagnostic group					
I. Leukemias	19	2.11			2.25
II. Lymphomas	15	1.67			1.66
III. Brain and spinal tumors	34	3.77			3.93
IV. and V. Neuroblastomas and Retinoblastomas **	7	0.77			0.94
VI. and VII. Kidney tumors and Liver tumors **	4	0.44			0.51
VIII. and IX. Bone tumors and Soft tissue sarcomas **	8	0.88			0.90
X. Germ cell tumors	11	1.22			1.15
XI. Other carcinomas and melanomas	9	1.00			0.95
XII. Other	7	0.78			0.74
Comparison ASIR					
	Both sexes	Girls	Boys	Period	Ages
Faroe Islands	13.03	11.94	14.04	1960–2019	0–19
Denmark [10]	17.68	16.07	19.22	1977–2014	0–19
Iceland [11]	14.5	12.8	16.1	1981–2006	0–18
Sweden [7]	15.99	14.98	16.95	1984–2010	0–14
62 countries – The Lancet [9]	15.58	14.36	16.32	2001–2010	0–19

*Age standardized incidence rate per 100,000 using the world standard weights; **Groups have been combined due to small numbers. ASIR: age-standardized incidence rates.

children ≤ 19 years in The Lancet study ranged from 8.7 per 100,000 pyrs in India to 19.2 per 100,000 pyrs in Southern Europe. The combined dataset showed an overall ASIR of 15.6 per 100,000 pyrs. The ASIR in the Faroe Islands for the same period was 11.6 per 100,000 pyrs, while it was 13.0 per 100,000 pyrs for the whole study period. In a study by Grabas et al. [10], childhood cancer incidence in Denmark showed an ASIR of 17.7 per 100,000 pyrs for the years 1977 to 2014, whereas Óskarsson et al. reported an ASIR for childhood cancer up to the age of 18 in Iceland of 14.5 per 100,000 pyrs [11]. In a report from 2013 in Sweden, the ASIR was 16.0 per 100,000 pyrs in the period 1984 to 2010, but in this case the age group was from 0 to 14 years [7]. Overall, childhood cancer appears to be slightly rarer in the Faroe Islands than in countries the Faroe Islands are often compared to as seen in table 1. [10].

Established risk factors for the development of childhood cancers are scarce. Lifestyle factors that cause a high proportion of adult cancers do not generally cause childhood cancer [12]. Some of the known risk factors for childhood cancer are affected fetal growth [13], genetics [14], and parental exposures [15]. Some of the differences observed between countries are

expected to be caused by different access to diagnostic tools required for diagnoses such as brain and spinal tumors [16], leading to a lower likelihood of receiving a cancer diagnosis. However, we find underdiagnosing an unlikely explanation for the slightly lower incidence observed in the Faroe Islands due to the generally high standard of health care and free access to health care. There might be a risk that some childhood cancers would not have been registered in the FCR since all children are sent abroad for treatment and diagnosis. We obtained data from the DCCR to address this potential limitation, where all Faroese children diagnosed after 1985 are expected to be registered.

Worldwide, survival for childhood cancer has improved considerably over time as treatments have improved. Acute lymphatic leukemia is one example of a cancer diagnosis where 5-year survival was below 10% in the 1960s and has increased to above 90% in some countries today [2]. The number of cases in the Faroe Islands is low, complicating any meaningful stratification by the type of cancer. Therefore, we grouped all childhood cancers for survival calculations and observed a markedly improved all-cause survival over time.

Even though survival has improved, survivors may experience

a wide range of long-term effects after a childhood cancer diagnosis [16, 17]. These long-term effects vary by cancer type but include secondary cancers [17, 18], increased risk of diabetes [19], lung and cardiac effects [17] as well as affected fertility [17, 20]. Research within this area is scarce in the Faroe Islands and is warranted.

A cancer diagnosis is a significant burden for any child and their family [21–24]. This burden might be exacerbated for Faroese families because the treatment is only given abroad. The family must deal with a severe medical diagnosis in their child in addition to either separating the family or moving the whole family to a new country.

The low number of cases in our data limits the certainty of any conclusion we can reach in this report. However, we believe that the national and lengthy coverage provides a robust evaluation of the childhood cancer rate in the Faroe Islands over time.

Childhood cancers are rare, and treatment advances mean that most children with cancer will survive. Research into the long-term somatic and socioeconomic effects of childhood cancer among survivors in the Faroe Islands should be considered.

Disclosure statement

The authors report there are no competing interests to declare.

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Data availability statement

The data supporting this study's findings are available from the corresponding author, Marnar Fríðheim Kristiansen, upon reasonable request and appropriate approvals.

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