Sztuka Leczenia
2023, tom 38, nr 1, ss. 15–22
https://doi.org/10.4467/18982026SZL.23.002.17916
https://www.ejournals.eu/SL/

Dariusz Góra

Pomeranian University Słupsk, Faculty of Health Sciences

The incidence of selected neoplastic diseases among children and adolescents in the Silesian Voivodeship

Zachorowalność wśród dzieci i młodzieży na wybrane choroby nowotworowe w województwie śląskim

ABSTRACT

Introduction. The causes of malignant neoplasms occurring in both children and adolescents remain unknown, but epidemiological and genetic studies have partially elucidated the origin of these tumors. Brain tumors are most common in children under 5 years of age. Adolescents aged 10–14 years are most likely to develop lymphomas and bone tumors.
Objective. The aim of the article is to discuss the incidence of selected neoplastic diseases in children and adolescents from the Silesian Voivodeship in 2010–2019. The article includes: lymphocytic leukemia (C 91), myeloid leukemia (C 92), cancer of the brain and central nervous system (D 43) and non-Hodgkin's lymphoma (C82-85).
Materials and methods. In March 2022, data on the incidence (absolute numbers) of selected neoplastic diseases among children and adolescents from 0 to 19 years of age (divided into age groups: under 1, 1 to 4, 5 to 14 and 15 to 19 life) from the Silesian Voivodeship were collected and analysed. Then, appropriate tables illustrating the incidence of the diseases in question were drawn up.
Results. In the age group between 5 and 14 years of age, the incidence of lymphocytic leukemia increased between 2010 and 2013 and amounted to 30 cases in 2010 and 39 in 2013, respectively. The lowest incidence of tumors of the brain and central nervous system among children and adolescents was recorded in 2011 (2 cases), in the years 2012–2014 the incidence was 7 cases per year, and from 2015 to 2019 the incidence increased and amounted to 8 in 2015 and 19 in 2019, respectively.
Conclusions. One of the reasons adversely affecting the diagnostic and therapeutic process is the rarity of these diseases in the pediatric patient population, which makes it difficult for the GPs to acquire their own professional experience in a short time. The second diagnostic difficulty is the different histological structure of tumors in children and adolescents.

Keywords: cancer epidemiology, lymphocytic leukemia, myeloid leukemia, tumors of the brain and central nervous system

Adres do korespondencji / Address for correspondence: dareczekg@op.pl
ORCID: https://orcid.org/0000-0001-7662-8812

STRESZCZENIE

Wprowadzenie. Przyczyny nowotworów złośliwych występujących zarówno u dzieci, jak i młodzieży pozostają nieznane, jednakże badania epidemiologiczne i genetyczne umożliwiają częściowe wyjaśnienie pochodzenia tych nowotworów. Guzy mózgu występują najczęściej u dzieci poniżej 5. roku życia. Na chłoniaki i guzy kości zapada przede wszystkim młodzież w wieku 10–14 lat.
Cel. Celem artykułu jest omówienie zachorowalności na wybrane choroby nowotworowe wśród dzieci i młodzieży z województwa śląskiego w latach 2010–2019. W artykule uwzględniono: białaczkę limfatyczną (C 91), białaczkę szpikową (C 92), nowotwór mózgu i ośrodkowego układu nerwowego (D 43) oraz chłoniaki nieziarnicze (C82–85).
Materiały i metody. W marcu 2022 roku otrzymano dane o zachorowalności (liczby bezwzględne) wybranych chorób nowotworowych wśród dzieci i młodzieży od 0 do 19. roku życia (z podziałem na grupy wiekowe: poniżej 1. roku życia, od 1. do 4., od 5. do 14. i od 15. do 19. roku życia) z województwa śląskiego. Następnie sporządzono odpowiednie tabele ilustrujące zachorowalność na omawiane choroby.
Wyniki. W grupie wiekowej między 5. a 14. rokiem życia zachorowalność na białaczkę limfatyczną wzrastała między 2010 a 2013 rokiem i wynosiła odpowiednio 30 w 2010 roku i 39 w 2013 roku. Wśród dzieci i młodzieży między 15. a 19. rokiem życia najniższa (2) zachorowalność na nowotwory mózgu i ośrodkowego układu nerwowego była w 2011 roku, w latach 2012–2014 zachorowalność ta wynosiła 7 przypadków rocznie, a począwszy od 2015 do 2019 roku liczba zachorowalności zwiększała się i wynosiła odpowiednio – 8 w 2015 i 19 w 2019 roku.
Wnioski. Jedną z przyczyn rzutujących niekorzystnie na proces diagnostyczno-terapeutyczny jest rzadkość występowania tych schorzeń w populacji dziecięcej, co utrudnia lekarzom pierwszego kontaktu nabycie w krótkim czasie własnych doświadczeń zawodowych. Drugim utrudnieniem diagnostycznym jest odmienna budowa histologiczna nowotworów występujących u dzieci i młodzieży. Mimo ogromnego postępu medycyny schorzenia te są nadal jedną z głównych przyczyn zgonów wśród chorych poniżej 16. roku życia i stanowią około 16% wszystkich przyczyn zgonów w tej grupie wiekowej.

Słowa kluczowe: epidemiologia nowotworów, białaczka limfatyczna, białaczka szpikowa, nowotwory mózgu i ośrodkowego układu nerwowego

Introduction

The causes of malignant neoplasms occurring in both children and adolescents remain unknown, but epidemiological and genetic studies have partially elucidated the origin of these tumors. The main factors that increase the risk of cancer formation in the human population in question are the individually specific increased predisposition to cancer as well as some disease syndromes such as congenital immunodeficiency, chronic inflammatory bowel disease, intestinal polyposis, and carcinogens known to induce cancer in humans. adults. Neoplastic disease mainly affects mature and elderly people, therefore, cancer in children and adolescents is less common than in adults. The type and age distribution of cancers in children and adolescents differs from the type and distribution of cancers in the adult population (Hełka, 2016). Some cancers are more common in certain age groups. In the first year of life, neuroblastoma, nephroblastoma and retinoblastoma are the most common. Between the ages of 2 and 5, acute lymphoblastic leukemia is at its peak. Brain tumors are most common in children under 5 years of age. On the other hand, adolescents aged 10–14 years mainly suffer from lymphomas and bone tumors (Stachowicz-Stencel, Krawczyk, Balcerska, 2010). In European countries, there are about 15,000 each year new cases of malignant neoplasms among children up to 14 years of age, and an additional 20,000 among adolescents and young adults aged 15–24 new cases. The number of children who have undergone cancer treatment is around 10,000. Every year the number of these children

will increase due to the fact that medicine is able to cure most of them. This is important because these children will require comprehensive monitoring in the future in terms of possible disease recurrence, as well as for the so-called late sequelae (Kowalczyk, 2011). The probability of developing oncological diseases among children and adolescents aged 1–15 years ranges from 1: 600 to 1: 450 of the respondents. It is also known that children constitute only 0.5% of new cancer cases in Poland, so only 1: 200 cancer patients are children and adolescents up to 18 years of age (Stachowicz-Stencel, Krawczyk, Balcerska, 2010).

Acute lymphoblastic leukemias (ALL) are considered childhood leukemias as 80% of all cases are diagnosed in children and only 20% in adults, with an annual incidence of 1–1.5 per 100,000. population. According to data from European registries, the annual incidence of ALL and LBL (lymphoblastic lymphoma) in adults is 1.28 per 100,000. population and shows significant age-related differentiation (respectively: 0.53, 1.0 and 1.45 for the population aged 45–54, 55–74 and 75–99) (Arber *et al.*, 2016; Inaba, Ching-Hon, 2021). The number of new cases in the population of Polish children is 220–250 annually. This neoplasm is a heterogeneous group of neoplastic diseases and is characterized by the presence of immature lymphoid cells in the bone marrow, blood and forming infiltrates in various organs (Derwich, Zając-Spychała, 2012). The causes of ALL have not yet been fully understood. Various factors may contribute. the risk of neoplastic transformation and the occurrence of ALL, the following are listed:

- genetic factors (<5% ALL occurs in genetic syndromes such as Down's syndrome, Klineferter's syndrome, Fanconi's anemia or ataxia-telangiectasia syndrome),
- viral infections – an association has been shown between Epstein-Barr virus infection and ALL from mature B cells, as well as infection with human T-cell leukemia virus type 1 and ALL / LBL from T cell precursor cells,
- maternal environment of fetal development (Kaleta *et al.*, 2019; Giebel *et al.*, 2019).

Acute myeloid leukemia (OSA) is a proliferative disease of the hematopoietic system in which there is a clonal proliferation and accumulation in the body of morphologically and functionally immature blast cells, derived from a precursor, tumor-transformed hematopoietic cell. Leukemia cells, infiltrating the bone marrow, displace normal cell lines, which causes the development of anemia, thrombocytopenia and neutropenia in most patients. They can also form infiltrates in various organs, which contributes to the rich and varied symptomatology of OSA (Hełka, 2016). In Europe, the prevalence and incidence of OSA deaths are estimated at 5–8 and 4–6 / 100,000 inhabitants / year, respectively (Stachowicz-Stencel, Krawczyk, Balcerska, 2010; Kowalczyk, 2011). Most of the sick are men (3: 2). The incidence of acute myeloid leukemias increases significantly with age, especially after the age of 70. Chronic myeloid leukemia is diagnosed in about 5% of children with leukemia (Matysiak, 2014).

Neoplasms of the central nervous system (CNS) are the most common solid neoplasms in children and the second, after leukemia, neoplastic disease of the developmental age. They account for nearly 30% of all childhood cancers. In Poland, about 250 new cases of CNS tumors are diagnosed each year. They usually occur in patients aged 3–10 years (mostly male), but they can occur in both infants and adolescents. Due to their location, brain tumors (90–95% – supratentorial and subtentorial) and spinal tumors (5–10%) are distinguished. Despite a significant improvement in treatment outcomes in pediatric oncology in Poland, CNS tumors are still the second most common cause of death in children with cancer (Bień, Krawczyk, Balcerska, 2011). Despite very aggressive treatment, it is a group of patients with a clearly worse prognosis than most children with other cancers. The analysis of 5-year survival periods in patients diagnosed with neoplastic disease shows that this effect is achieved by 75% of respondents. In the group of patients diagnosed with CNS tumors, the achieved 5-year survival rate is lower and amounts to 65%. Detailed evaluation of experiences depending on the histological structure of the tumor located in the CNS shows even worse

therapeutic effects (Van Schoors *et al.*, 2019; Testa, Venturelli, Felice-Brizzi, 2021).

Non-Hodgkin's lymphoma is a heterogeneous group of neoplasms of the lymphatic system, i.e. the immune system responsible for the body's defense mechanisms. They are formed as a result of uncontrolled multiplication of cells of the lymphatic system belonging to the B or T cell lines. B and T lymphocytes are responsible for the body's defense mechanisms through various processes. Therefore, these neoplasms have a common origin, and the difference concerns the primary localization of the neoplastic process in the bone marrow in the case of leukemias or in the lymphatic system in the case of non-Hodgkin's lymphoma (Van Schoors *et al.*, 2011; Thandra *et al.*, 2021). It is estimated that non-Hodgkin's lymphomas account for about 6% of all cancers in children. In Poland, nearly 30 new cases of illness are recorded among children each year, but most often between the ages of 5 and 15 (Warzocha, Lech-Marańda, 2011).

Objective of the work

The aim of the article is to discuss the epidemiology of selected neoplastic diseases (morbidity and hospitalization) of children and adolescents from the Silesian Voivodeship in 2010–2019. The article covers: lymphocytic leukemia (C 91), myeloid leukemia (C 92), cancer of the brain and central nervous system (D 43) and non-Hodgkin's lymphoma (C82-85).

Material and methods

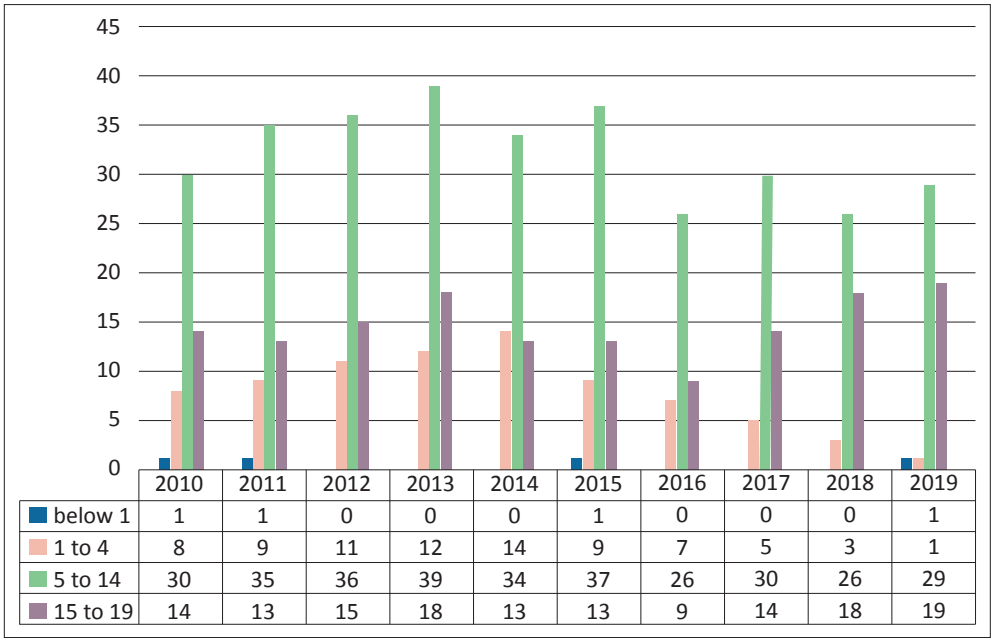
In March 2022, data on the incidence and hospitalization (absolute numbers) of selected neoplastic diseases among children and adolescents from 0 to 19 years of age were obtained (divided into age groups: under 1, 1 to 4, 5 to 14 and 15 up to 19 years of age) from the Silesian Voivodeship. These data concern the years 2010–2019 and come from the National Health Fund – Silesian Branch in Katowice. Then, figures were prepared that illustrate the morbidity and hospitalization of the diseases in question.

Results

In 2010, 2011, as well as in 2015 and 2019, there were single cases of lymphocytic leukemia in newborns under the age of 1, while in 2012–2014 and 2016–2018 no incidence was recorded. The variable nature of the incidence was noted in the group of children between 1 and 4 years of age. In 2010–2014, the incidence increased and amounted to 8 in 2010 and 4 in 2014. In 2015–2019, the incidence decreased and amounted to 9 in 2015 and 1 in 2019, respectively. In the age group between 5 and 14 years of age, the incidence increased between 2010 and 2013 and amounted to 30 in 2010 and 39 in 2013, respectively. The lowest (26) incidence was in 2016 and 2018. Among children and adolescents between 15 and 19 years of age, the lowest (9) incidence was in 2016 and the highest (19) in 2019 (Fig. 1).

Over the analyzed period, only in 2014 a single case of lymphocytic leukemia was reported among newborns under the age of 1. The highest (5) number of children in the age group between 1 and 4 was recorded in 2015, and the lowest (1) in 2011 and 2017–2019. In the age group between 5 and 14 years of age, the incidence was variable and ranged between 2 (2019) and 9 (2013 and 2015). Among children and adolescents between 15 and 19 years of age, the lowest (2) incidence was in 2015 and 2016, and the highest (8) in 2011 (Fig. 2).

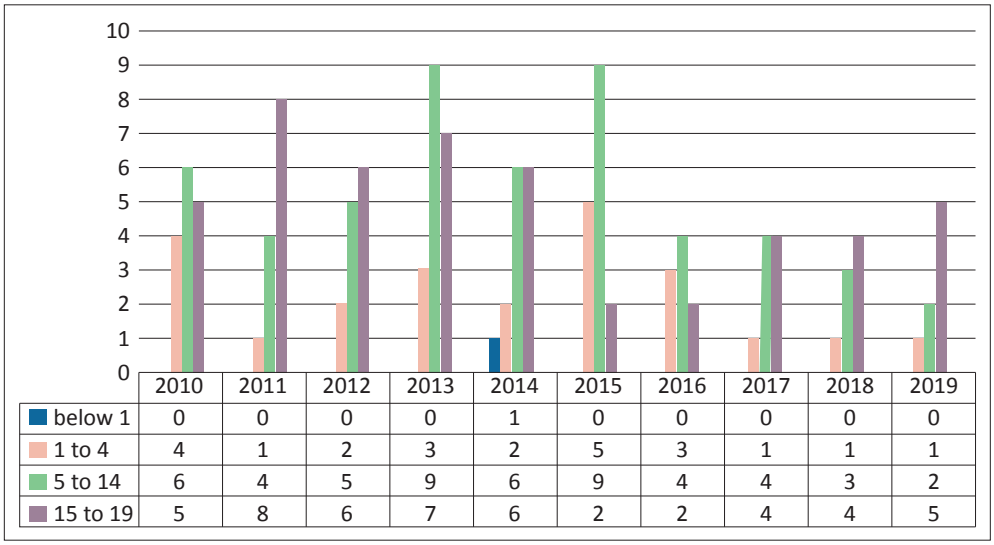
In the analyzed period, no cases of brain and central nervous system tumors were reported among newborns below 1 year of age. The variable nature of the incidence was noted in the group of children between 1 and 4 years of age. In 2010, 2012 and 2018, there were isolated cases of morbidity. In 2016, 2017 and 2019, the incidence increased to 4. In the age group between 5 and 14 years of age, the incidence was between 4 (2010) and 9 cases in 20112, 2014 and 2019. Among children and adolescents, between 15 and 19 years of age, the lowest (2) incidence was in 2011, in the years 2012–2014 the incidence was 7 cases per year, and from 2015 to 2019 the nature of the incidence increased and amounted to 8 in 2015 and 19 in 2019, respectively (Fig. 3).



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
below 1	1	1	0	0	0	1	0	0	0	1
1 to 4	8	9	11	12	14	9	7	5	3	1
5 to 14	30	35	36	39	34	37	26	30	26	29
15 to 19	14	13	15	18	13	13	9	14	18	19

Figure 1. Data from 2010–2019 on the incidence of lymphocytic leukemia in children and adolescents aged 0–19 (divided into age groups) in the Silesian Voivodeship

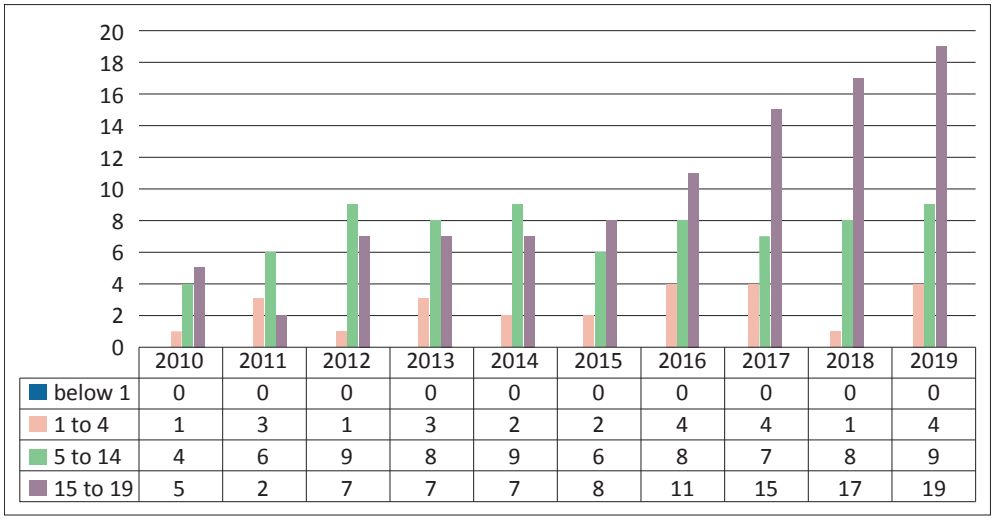
Source: study based on data from the National Health Fund – Silesian Branch in Katowice.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
below 1	0	0	0	0	1	0	0	0	0	0
1 to 4	4	1	2	3	2	5	3	1	1	1
5 to 14	6	4	5	9	6	9	4	4	3	2
15 to 19	5	8	6	7	6	2	2	4	4	5

Figure 2. Data from 2010–2019 on the incidence of myeloid leukemia in children and adolescents aged 0–19 (divided into age groups) in the Silesian Voivodeship

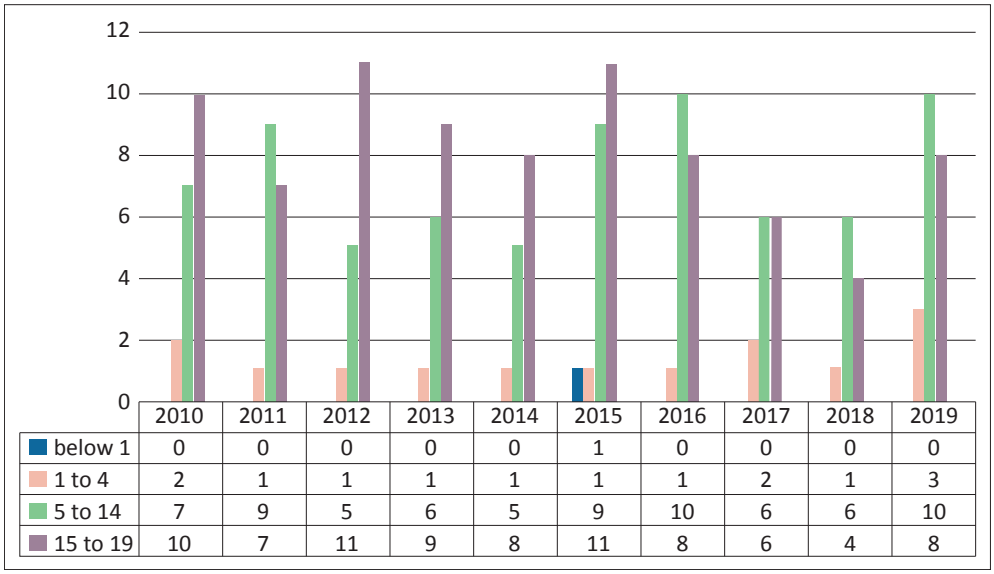
Source: study based on data from the National Health Fund – Silesian Branch in Katowice.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
below 1	0	0	0	0	0	0	0	0	0	0
1 to 4	1	3	1	3	2	2	4	4	1	4
5 to 14	4	6	9	8	9	6	8	7	8	9
15 to 19	5	2	7	7	7	8	11	15	17	19

Figure 3. Data from 2010–2019 on the incidence of brain and central nervous system cancer in children and adolescents aged 0–19 (broken down by age groups) in the Silesian Voivodeship

Source: study based on data from the National Health Fund – Silesian Branch in Katowice.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
below 1	0	0	0	0	0	1	0	0	0	0
1 to 4	2	1	1	1	1	1	1	2	1	3
5 to 14	7	9	5	6	5	9	10	6	6	10
15 to 19	10	7	11	9	8	11	8	6	4	8

Figure 4. Data from 2010–2019 on the incidence of non-Hodgkin's lymphomas in children and adolescents aged 0–19 (broken down by age groups) in the Silesian Voivodeship

Source: study based on data from the National Health Fund – Silesian Branch in Katowice.

Over the analyzed period, a single case of non-Hodgkin's lymphoma was reported in 2015 alone among newborns under 1 year of age. The highest (3) number of children in the age group between 1 and 4 years old was recorded in 2019, and the lowest (1) in 2011–2016 and 2018. In the age group between 5 and 14 years of age, the incidence was variable and amounted to between 5 (2012 and 2014) and 10 cases (2016 and 2019). Among children and adolescents between 15 and 19 years of age, the lowest (4) incidence was in 2018 and the highest (11) in 2012 and 2015 (Fig. 4).

Conclusions and discussion

Childhood cancers are rare diseases. According to the latest data in Poland, the prevalence of neoplastic diseases in the pediatric population is estimated at about 151: 1 million children per year. The five-year overall survival for children treated for the most common pediatric hyperplasia, acute lymphoblastic leukemia (ALL) according to the ALLIC 2010 protocol is 86%. The most common childhood cancer is leukemia. It accounts for 27% of all illnesses. Neoplasms located in the central nervous system are in second place – 23%. The third most common are lymphomas, responsible for about 15% of cases (Hełka, 2016). One of the reasons adversely affecting the diagnostic and therapeutic process is the rarity of these diseases in the pediatric population, which makes it difficult for GPs to acquire their own professional experience in a short time. The second diagnostic difficulty is the different histological structure of tumors in children and adolescents, which determines a different clinical symptomatology, so that the medical experience acquired in the treatment of the adult population cannot be transferred to pediatric patients. Neoplasms occurring in children are non-epithelial and their histological specificity largely depends on the patient's age at the time of the onset (Hełka, 2016; Kapała *et al.*, 2016). In the first year of life, tumors of embryonic origin are observed, which include: sympathetic neuroblastoma (neuroblastoma), nephroblastoma (Wilms' tumor, nephroblastoma) and retinoblastoma (retinoblastoma). Between the ages of 2 and 4, the incidence of leukemia, most of which is acute lymphoblastic leukemia (ALL), is at its peak. In school-age children and adolescents, there are: Hodgkin's (HL) and non-Hodgkin's lymphomas (NHL) as well as bone tumors and soft tissue neoplasms (Stachowicz-Stencel, Krawczyk, Balcerska, 2010), which was confirmed by the analysis of the morbidity and hospitalized children between 0 and 19 years of age. However, despite the enormous progress in medicine, they are still one of the main causes of death among patients under 16 years of age, accounting for about 16% of all causes of death in this age group (Kapała *et al.*, 2016; Zatoński, Wojciechowska, Didkowska, 2014).

Due to its intended use, i.e. the destruction of neoplastic cells, anti-cancer treatment causes many complications that may be felt for many years after the end of treatment. Therefore, proper prophylaxis of patients who contracted cancer in childhood is extremely important. Proper prophylaxis should be based on regular medical visits, carrying out preventive examinations, careful observation of your body in search of disturbing symptoms, and a healthy lifestyle (Styczyński, 2019).

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Źródła finansowania / Funding sources: brak źrodeł finansowania / no sources of financing
Konflikt interesów / Conflict of interest: brak konfliktu / no conflict of interest
Otrzymano/Received: 17.01.2023
Zaakceptowano/Accepted: 20.03.2023