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ORIGINAL RESEARCH ARTICLE

Incidence and prevalence of lymphatic neoplasms in Poland 2009–2015 determined on analysis of National Health Fund data used in the 'Maps of healthcare needs — database of systemic and implementation analyses' project

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Abstract

Introduction: The need for epidemiological data on blood neoplasms is driven by both systemic and scientific requirements. Due to the fact that all services provided to patients with these cancers in Poland are reported to the National Health Fund (NHF), the aim of this study was to try to use this data to estimate the incidence and prevalence of lymphatic neoplasms in Poland, as well as to determine overall survival (OS) in this group of patients.

Materials and methods: The analysis was carried out as part of the 'Maps of health needs — database of system and implementation analyses' project, co-financed by the European Union through the European Social Fund under the Operational Program Knowledge Education Development.

Results: The registered incidence of follicular lymphoma (FL) in 2014 was 1.74/100,000, whilst the registered prevalence was 15.56/100,000. The median OS of patients registered in the NHF system in 2009–2015 with an FL diagnosis was over 60 months, and the estimated 3- and 5-year OS rates were 76.6% and 68.8% respectively. In 2014, the incidence and prevalence of diffuse large B-cell lymphomas (DLBCL) was 3.76/100,000 and 27.48/100,000, respectively. The median OS was over 60 months, and the estimated 3- and 5-year OS rates were 68.7% and 61.1%, respectively. On the other hand, the incidence and prevalence of chronic lymphocytic leukemia (CLL) were 8.65/100,000/year and 38.28/100,000/year, respectively. The median OS was over 60 months, and the estimated 3- and 5-year OS rates were 77.8% and 64.8%, respectively. In the case of plasma cell myeloma (PCM), the registered incidence and prevalence were 4.92/100,000/year and 23.28/100,000/year, respectively. The median OS was 60 months, and the 3- and 5-year OS rates were 62.8% and 49.7%, respectively.

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Conclusions: The data reported to the National Health Fund in order to obtain reimbursement of medical services seems to be the most reliable data covering such a large population of patients. The results are similar to data from European and American registries for DLBCL and PCM. However, the FL and CLL data requires further verification.

Key words: registered incidence, registered morbidity, overall survival probability, follicular lymphoma, diffuse large B-cell lymphoma, chronic lymphocytic leukemia, plasma cell myeloma

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Introduction

Epidemiological data on lymphatic neoplasms are well characterized in many registries. However, most national registries and epidemiological studies do not cover the specific subtypes of lymphoma defined according to the World Health Organization (WHO) classification, except for chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) and plasma cell myeloma (PCM). Much less precise epidemiological data is available for the most common lymphoma subtypes, i.e. diffuse large B-cell lymphoma (DLBCL) or follicular lymphoma (FL).

It must be emphasized, however, that in recent years there has been a clear tendency towards more detailed reporting of data regarding the incidence of individual lymphoma subtypes. This is, among other things, related to the high heterogeneity of the clinical course of these neoplasms, and thus the different amounts of funding allocated to medical care [1–4].

In Poland, cases of newly diagnosed cancers are reported to the National Cancer Registry (NCR). Currently, the 10th Revision of the International Statistical Classification of Diseases and Health-Related Problems (ICD-10) is in force in Poland, and all entities contributing to the public statistics research program are obliged to apply this version. However, the cancer incidence data collected in the NCR seems to be underestimated, for various reasons [5]. For example, in the case of solid tumors, in the NCR there was an average 26% underestimation, and depending on the type of cancer this figure ranges from 14% (breast cancer) to 50% (salivary gland cancer) [6].

New cases of hematological malignancies are also reported to the NCR, and under the common name 'lymphoid and hematopoietic tissue tumors' (ICD-10 C81–C96) are grouped as follows: Hodgkin lymphoma (ICD-10 C81), non-Hodgkin lymphomas (ICD-10 C82–C85), multiple myeloma and malignant plasma cell neoplasms (ICD-10 C90), leukemias (ICD-10 C91–95), lymphocytic leukemia (ICD-10 C91), and myeloid leukemia (ICD-10 C92). The current ICD-10 makes it difficult to obtain epidemiological data on hematological malignancies in accordance with the current WHO classification. The published epidemiological data, which is generally available on the NCR website, is limited to two-digit ICD-10 codes, which, inter alia, make it impossible to distinguish between acute lymphoblastic leukemia (C91.0) and CLL (C91.1) and between acute myeloid leukemias (AML) and chronic myelogenous leukemia (CML) (C92.1) [5].

On the other hand, all healthcare entities financed from public funds, when reporting the provision of medical services to the National Health Fund (NHF), report cancer diagnoses according to the ICD-10 classification in a 5-character format, which allows for a more precise determination of cancer type, including the differentiation of acute from chronic leukemias. Moreover, due to reporting to the PESEL level, it is also possible to determine morbidity by analyzing the patient care pathway [5].

The aim of this study was to analyze the data of the National Health Fund in order to determine the incidence and prevalence of the four most common lymphatic neoplasms in Poland, as well as to estimate overall survival (OS) in this group of patients irrespective of the cause of death.

Materials and methods

The analysis was carried out as part of the project entitled 'Maps of Healthcare Needs—Database of Systemic and Implementation Analyses' co-financed by the European Union through the European Social Fund under the Operational Program Knowledge Education Development. As part of this project, on 31 December, 2016, the 'Health Needs Maps — database of system and implementation analyses' was published on the website of the Ministry of Health [7]. The project was implemented by the Department of Analyses and Strategies of the Ministry of Health, and its aim was to improve the quality of management in the healthcare system by supporting data-based management decisions. Regular preparation and publication of analyses leads to a substantive discussion on the healthcare system and substantive explanation of management decisions at the national (macro) level, the regional (meso) level, and the individual service provider (micro) level [5, 7].

In 'Maps of health needs — database of system and implementation analyses', hematological malignancies were grouped based on the WHO classification, using the ICD-10 classification codes used in reporting to the National

Health Fund. The analyses used pseudonymized data reported to the National Health Fund in the SWIAD message for the period 1 January, 2014, to 31 December, 2014, as well as on data on deaths recorded in the Social Insurance Central Registry. The analyses included those patients reported to the National Health Fund with diagnoses of FL (codes ICD-10: C82, C82.0, C82.1, C82.2, C82.3, C82.7 i C82.9), DLBCL (codes ICD-10: C83, C83.0, C83.1, C83.2, C83.3, C83.4, C83.5, C83.6, C83.7, C83.8, C83.9), CLL (codes ICD-10: C91.1), and PCM (codes ICD-10: C90, C90.0, C90.1, C90.2).

Bearing in mind that from an epidemiological point of view lymphatic neoplasms are considered to be non-transient, i.e. chronic, diseases, the registered incidence and the registered prevalence of particular groups of malignancies were calculated. The term 'registered' was introduced to indicate that this is not an incidence or prevalence determined on the basis of epidemiological studies, but rather based on events registered by the public payer [5, 7].

The 'registered incidence' rate was defined as the number of newly diagnosed patients reported under the healthcare system financed from public funds per 100,000 inhabitants during the year. In the case of chronic diseases, the incidence was calculated for 2014, based on the National Health Fund data from 2009–2015 (giving the possibility of analyzing the patient's history at least five years backwards and one year forwards). A patient reported to the NHF in this period was considered a new one (a first-time patient) if he or she was diagnosed for the first time in 2014. The number of new cases in the public healthcare system (registered incidence) should take into account each first appearance of a patient in the system. However, due to the fact that the analysis was carried out based on the National Health Fund data, wherever it was possible to report a diagnosis which could not be confirmed until later after referral to a specialist center, the rule was adopted that only those patients who appeared in the public healthcare system at least twice could be regarded as patients with a given diagnosis, which therefore means having a given disease [5, 7]. In the case of FL and DLBCL incidence, due to the potential difficulty of making a precise diagnosis outside a hematooncological center, an additional criterion for identifying a new diagnosis was adopted: i.e. the first contact of the patient with a diagnosis appropriate for the analyzed group of lymphomas (codes C82 with extensions for FL, codes C83 with extensions for DLBCL) or with a diagnosis of C85 (other and unspecified types of non-Hodgkin lymphoma), and the second contact of the patient reported with the diagnosis of C82 with extensions for FL or C83 with extensions for DLBCL. Three ways of 'entering' the patient into the system were considered: hospital, specialist outpatient care, and hospital emergency department [7]. The incidence rates recorded for 2014 were stratified by age and by gender [5].

The 'prevalence' rate was defined by registering all patients reported in a given year, totalling the number of patients who were first reported to the system in a given year and the patients who had been reported as newly diagnosed in previous years but who were still alive in the year for which the analysis was performed, regardless of whether or not they were provided with medical services for hematological malignancy in the course of that particular year. Registered morbidity was estimated as of 31 December, 2014. This means that all patients classified as new cases in the public healthcare system since 2009 and who had not died by 31 December, 2014, were considered to be registered cases on that date. We must underscore that the analysis at the voivodeship level took into account the patient's place of residence declared to the public payer, not the place where the service was provided [5, 7].

The probability of OS was estimated based on the Kaplan-Meier method, and the patient's survival was calculated in the period from diagnosis to death, regardless of its cause. The analyses and visualizations were made with the use of R software, version 3.3.1, and IDE RStudio, version 1.0.136 [8–13].

Results

Follicular lymphoma

There were 700 newly diagnosed cases of FL in adults in 2014, with a registered incidence of 1.74/100,000 population. The number of patients with FL in Poland was estimated at 6,000, and the registered prevalence was 15.56/100,000. The registered incidence and prevalence rates for individual voivodeships are set out in Table I. Figure 1 shows FL incidence, with the size of the district reflecting the absolute number of new cases in a given voivodeship [the highest (100) being in Silesia voivodeship and the lowest (12) in Podlaskie voivodeship], taking into account the three means of patient 'entry' into the system described above. The color intensity of the voivodeship shows the incidence level per 100,000 population (the highest value, 2.21, in Subcarpathia voivodeship, and the lowest value, 0.97, in Warmia–Masuria voivodeship).

In 2014, among FL patients, male and female patients accounted for 46% and 54%, respectively. The FL registered incidence by sex in individual provinces is set out in Figure 2.

The median age of patients reported using FL codes was 62 years (range 18–96): women 63 (18–93 years) and men 61 (21–96 years). Figure 3 shows the structure of the registered incidence by age group, and Figure 4 shows the registered incidence by age group in individual voivodeships.

Based on the dates of death, the probability of OS was estimated in all patients registered in the National Health

Table I. Registered incidence and prevalence rates for follicular lymphoma according to defined region of Poland

Province/country	Incidence per 100,000	Prevalence per 100,000
POLAND	**1.74**	**15.56**
Lower Silesia	1.99	16.06
Kuyavia–Pomerania	1.63	12.25
Lublin	1.35	8.80
Lubusz	1.27	16.76
Lodz	1.28	11.15
Lesser Poland	2.11	13.39
Masovia	1.78	14.66
Opole	2.00	25.89
Subcarpathia	2.21	16.21
Podlaskie	1.01	12.17
Pomerania	1.74	17.42
Silesia	2.18	23.56
Holy Cross Province	1.03	11.48
Warmia–Masuria	0.97	11.15
Greater Poland	1.87	18.26
West Pomerania	1.46	12.77

Fund in 2009–2014 with the diagnoses of FL, i.e. C82, C82.0, C82.1, C82.2, C82.3, C82.7 and C82.9 (Figure 5). Median OS was over 60 months. The estimated 3-year and the 5-year OS rates were 76.6% and 68.8%, respectively. The probability of OS in patients reported using the above-mentioned ICD-10 codes was also calculated by age groups with respective 3-year and 5-year OS rates (Figure 6, Table II).

Diffuse large B-cell lymphomas

There were 1,400 newly diagnosed cases of DLBCL in adults in 2014 with the registered incidence of 3.76/100,000 population. The number of patients with DLBCL in Poland was estimated at 10,600, and the registered prevalence was 27.48/100,000. The registered incidence and prevalence rates for individual voivodeships are set out in Table III. Figure 7 shows DLBCL incidence, with the size of the district reflecting the absolute number of new cases in a given voivodeship [the highest (200) in Masovia voivodeship and the lowest (30) in Lubusz voivodeship], taking into account the three ways of patient entry to the system. The color intensity of the voivodeship shows the incidence level per 100,000 population (the highest value of 5.21 in Subcarpathia voivodeship, and the lowest value of 2.60 in Podlaskie voivodeship).

In 2014, among DLBCL patients, male and female patients accounted for 49% and 51%, respectively. The DLBCL registered incidence by sex in individual provinces is set out in Figure 8.

The median age of patients reported using DLBCL codes was 65 years (range 18–96): women 66 (18–96) and men 63 (18–96). Figure 9 shows the structure of the registered incidence by age group, and Figure 10 shows the registered incidence by age group in individual voivodeships.

Based on the dates of death, the probability of OS was estimated in all patients registered in the National Health Fund in 2009–2014 with the diagnoses of DLBCL, i.e. C83, C83.0, C83.1, C83.2, C83.3, C83.4, C83.5, C83.6, C83.7, C83.8, C83.9 (Figure 11). Median OS was over 60 months. The estimated 3-year and 5-year OS rates were 68.7% and 61.1%, respectively. The probability of OS in patients reported using the above-mentioned ICD-10 codes was also calculated by age groups with respective 3-year and 5-year OS rates (Figure 12, Table IV).

Chronic lymphocytic leukemia

There were 3,300 newly diagnosed cases of CLL in adults in 2014 with the registered incidence of 8.65/100,000 population. The number of patients with CLL in Poland was estimated at 14,700, and the registered prevalence was 38.28/100,000. The registered incidence and prevalence rates for individual voivodeships are set out in Table V. Figure 13 shows CLL incidence, with the size of the district reflecting the absolute number of new cases in a given voivodeship [the highest (700) in Lodz voivodeship and the lowest (43) in Lubusz voivodeship], taking into account the three ways of patient entry to the system. The color intensity of the voivodeship shows the incidence level per 100,000

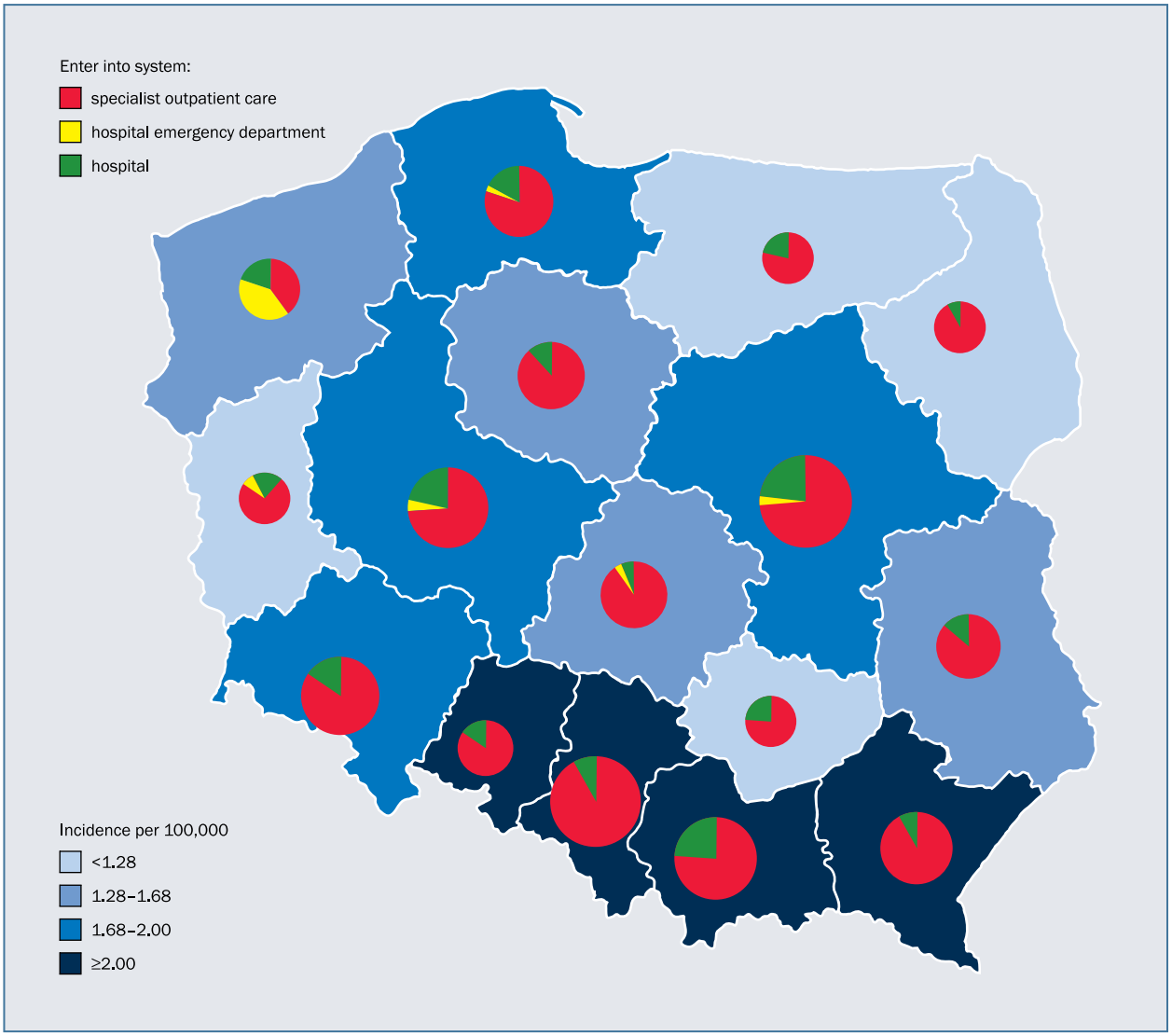

Figure 1. Registered incidence rate for follicular lymphoma according to defined region of Poland

population (the highest value of 29.20 in Lodz voivodeship, and the lowest value of 4.22 in Lubusz voivodeship).

In 2014, among CLL patients, male and female patients accounted for 55% and 45%, respectively. The CLL registered incidence by sex in individual provinces is presented in Figure 14.

The median age of patients reported using CLL codes was 69 years (range 20–101 years): women 71 (20–101) and men 68 (21–97). Figure 15 shows the structure of the registered incidence by age group, and Figure 16 shows the registered incidence by age group in individual voivodeships.

Based on the dates of death, the probability of OS was estimated in all patients registered in the National Health Fund in 2009–2014 with the diagnoses of CLL, i.e. C91.1 (Figure 17). Median OS was over 60 months. The estimated 3-year and 5-year OS rates were 77.8% and 64.8%, respectively. The probability of OS in patients reported using the above-mentioned ICD-10 codes was also calculated by age groups with respective 3-year and 5-year OS rates (Figure 18, Table VI).

Plasma cell myeloma

There were 1,900 newly diagnosed cases of PCM in adults in 2014 with the registered incidence of 4.92/100,000 population. The number of patients with DLBCL in Poland was estimated at 9,000, and the registered prevalence was 23.28/100,000. The registered incidence and prevalence rates for individual voivodeships are set out in Table VII. Figure 19 shows PCM incidence, with the size of the district reflecting the absolute number of new cases in a given voivodeship [the highest (400) in Masovia voivodeship and the lowest (44) in Lubusz voivodeship], taking into account the three ways of patient entry to the system. The color

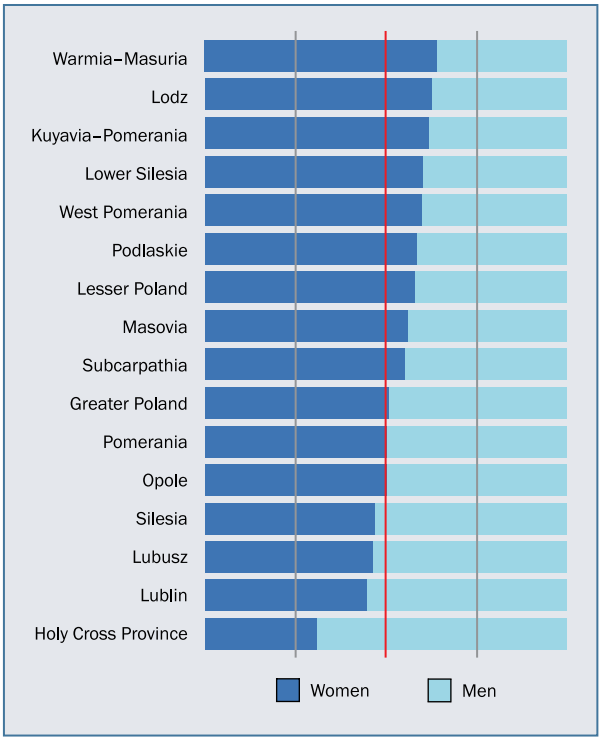

Figure 2. Pattern of registered incidence of follicular lymphoma according to gender and region of Poland

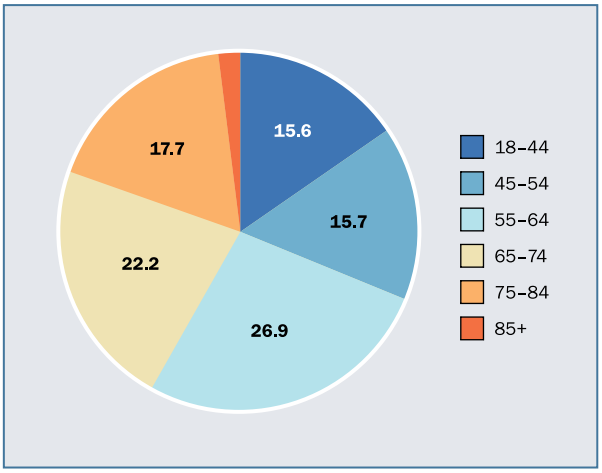

Figure 3. Pattern of registered incidence of follicular lymphoma according to age group

intensity of the voivodeship shows the incidence level per 100,000 population (the highest value of 6.84 in Masovia voivodeship, and the lowest value of 3.19 in Warmia–Masuria voivodeship).

In 2014, among PCM patients, male and female patients accounted for 48% and 52%, respectively. The DLBCL

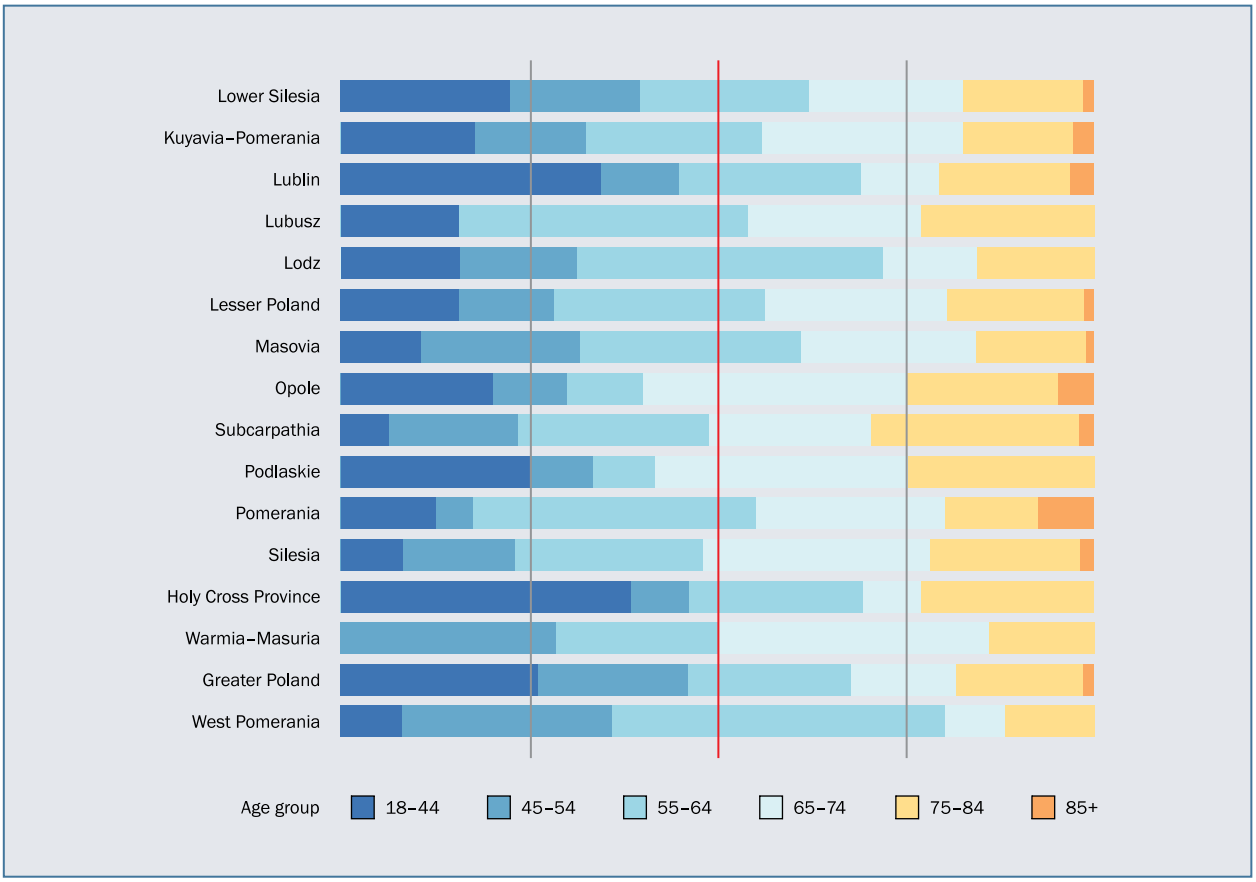

Figure 4. Pattern of registered incidence of follicular lymphoma according to age group and region of Poland

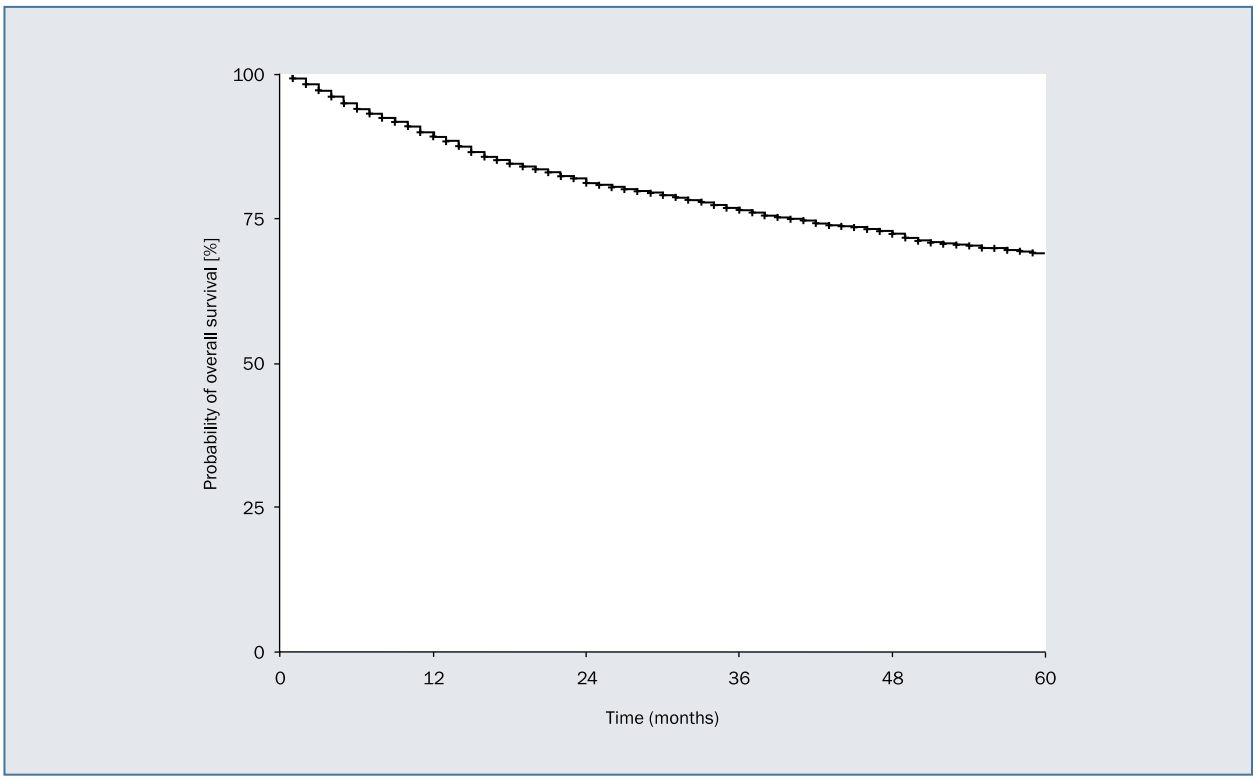

Figure 5. Probability of overall survival in patients registered with follicular lymphoma

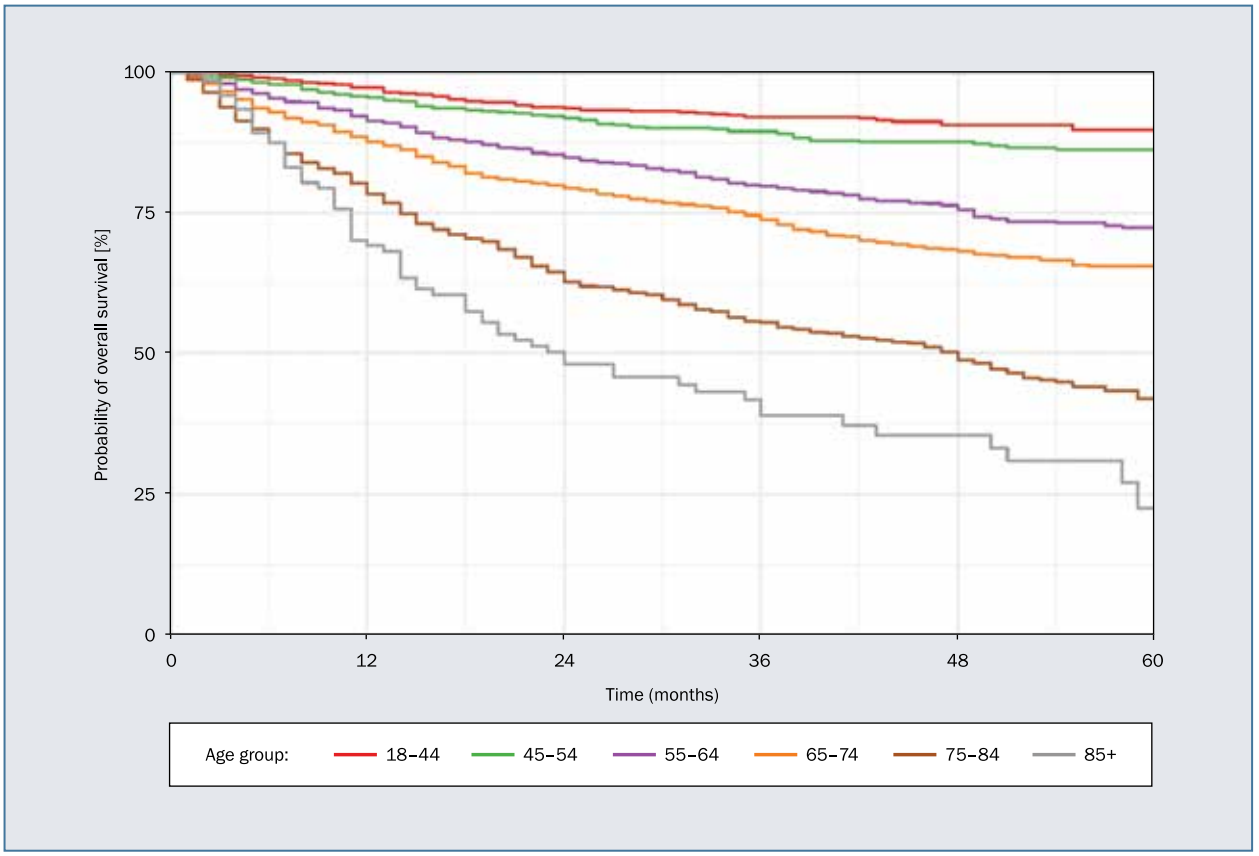

Figure 6. Probability of overall survival in patients registered with follicular lymphoma according to age group

Table II. Estimated 3- and 5-year overall survival (OS) in patients registered with follicular lymphoma according to age group

Age group (years)	Median (months)	3-year OS (range)	5- year OS (range)
18–44	>60	92% (90–94%)	90% (87–92%)
45–54	>60	89% (87–92%)	86% (83–89%)
55–64	>60	80% (77–82%)	72% (69–75%)
65–74	>60	74% (71–77%)	65% (61–68%)
75–84	48	55% (52–59%)	41% (37–46%)
85+	24	39% (30–50%)	23% (13–39%)

Table III. Registered incidence and prevalence rates for diffuse large B-cell lymphomas according to defined region of Poland

Province/country	Incidence per 100,000	Prevalence per 100,000
POLAND	**3.76**	**27.48**
Lower Silesia	3.99	25.59
Kuyavia–Pomerania	3.25	18.90
Lublin	5.17	31.34
Lubusz	2.94	25.39
Lodz	4.15	28.68
Lesser Poland	4.10	38.84
Masovia	3.54	31.57
Opole	3.10	24.79
Subcarpathia	5.21	31.52
Podlaskie	2.60	18.12
Pomerania	4.61	27.16
Silesia	3.18	23.95
Holy Cross Province	3.17	21.78
Warmia–Masuria	3.53	29.92
Greater Poland	3.37	22.73
West Pomerania	3.32	25.48

registered incidence by sex in individual provinces is set out in Figure 20.

The median age of patients reported using PCM codes was 67 years (range 18–95 years): women 69 (18–95) and men 66 (18–94). Figure 21 shows the structure of the registered incidence by age group, and Figure 22 shows the registered incidence by age group in individual voivodeships.

Based on the dates of death, the probability of OS was estimated in all patients registered in the National Health Fund in 2009–2014 with the diagnoses of PCM, i.e. C90, C90.0, C90.1, C90.2 (Figure 23). Median OS was over 60 months. The estimated 3-year and 5-year OS rates were 62.8% and 49.7%, respectively. The probability of OS in patients reported using the above-mentioned ICD-10 codes was also calculated by age groups with respective 3-year and 5-year OS rates (Figure 24, Table VIII).

Discussion

Follicular lymphoma

According to the European HAEMACARE study, which reported the incidence data of hematological malignancies from 44 European registries between 2000 and 2002, the raw incidence rate of FL in Europe was 2.18/100,000/year (4,881 new cases) [14]. In the British Hematological Malignancy Research Network (HMRN) registry, in which the reported data concerned several subtypes of lymphomas, the raw incidence rate of FL in 2004–2014 was 3.23/100,000/year [15]. In turn, according to the SEER (Surveillance, Epidemiology, and End Results Program) of the NCI (US National Cancer Institute), the total standardized incidence rate of malignant lymphoma, regardless of subtype, in 2010–2014 was 19.5/100,000/year [1].

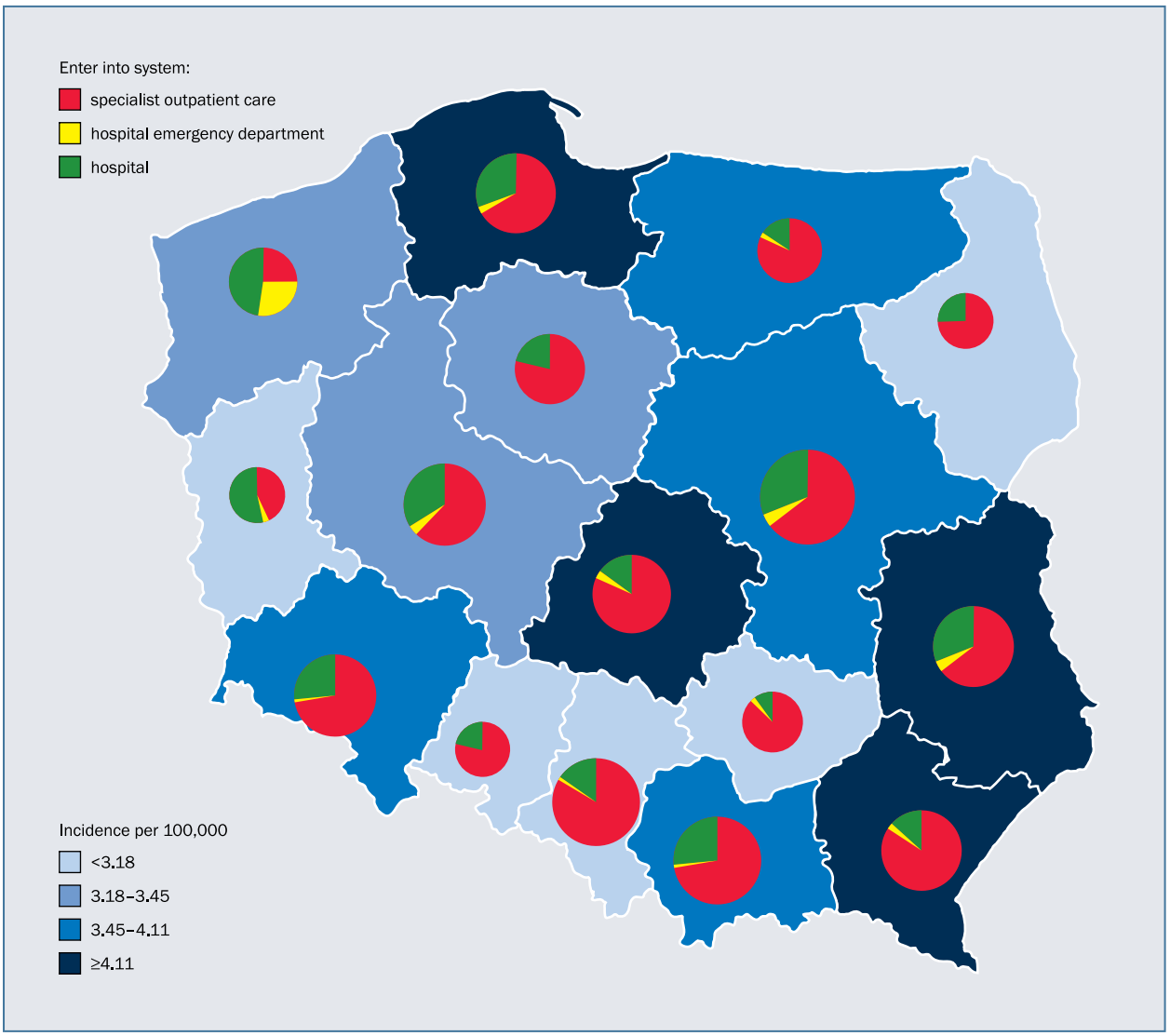

Figure 7. Registered incidence rate of diffuse large B-cell lymphomas according to defined regions of Poland

Difficulties in the analysis of epidemiological data on individual subtypes of non-Hodgkin lymphomas (NHL) result from the fact that the clinical and pathomorphological classifications of these neoplasms have changed many times over the last 50 years [16]. In order to facilitate the analysis of NHL epidemiological data, the Pathology Working Group of the International Lymphoma Epidemiology Consortium (PWG–InterLymph) proposed a classification of lymphatic neoplasms based on the current WHO classifications and the International Classification of Diseases–Oncology Third Edition (ICD-O-3) [16, 17]. Morton et al. used the PWG–InterLymph classification to analyze the epidemiological data of the SEER database for 2001–2003 and determined the incidence of FL to be 3.51/100,000/year (7,543 new cases) [16].

According to unpublished NCR data (data obtained courtesy of Prof. J. Didkowska as part of the cooperation in the above-mentioned project), the incidence of FL in Poland in 2010–2014 was 1.12 (430 new cases), and this was lower than the registered incidence rate (1.74/100,000/year) calculated on the basis of data reported to the National Health Fund. The differences also concerned the prevalence rate, which according to the NCR data was 4.36/100,000, and the number of patients with FL in Poland was estimated at 1,677. The prevalence obtained based on analysis of data reported to the National Health Fund was 15.56/100,000, which translates to some 6,000 patients with FL and is comparable with the data from the British HMRN registry [15]. A comparative analysis of data obtained from the National Health Fund and the NCR indicates the need to improve the reporting of FL cases to the NCR.

Nevertheless, both the recorded incidence and the incidence rates of FL according to the NCR data are lower than the values observed in the HAEMACARE study, the

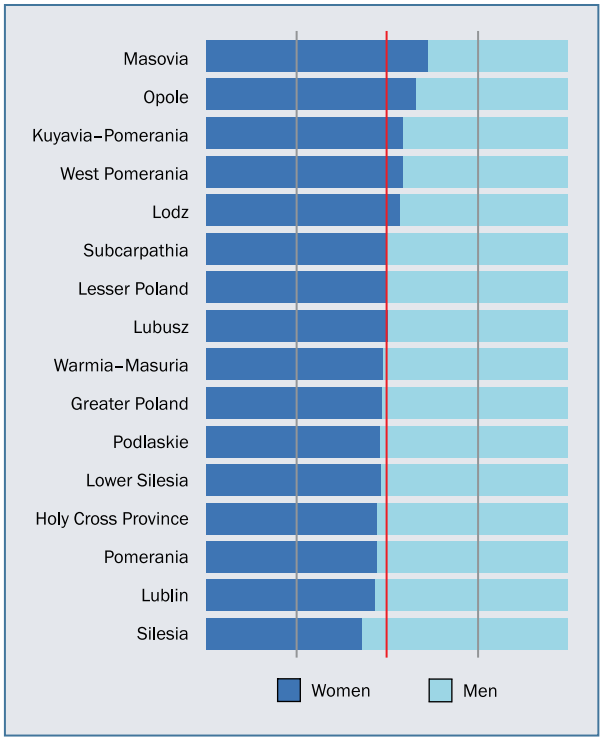

Figure 8. Pattern of registered incidence of diffuse large B-cell lymphomas according to gender and region of Poland

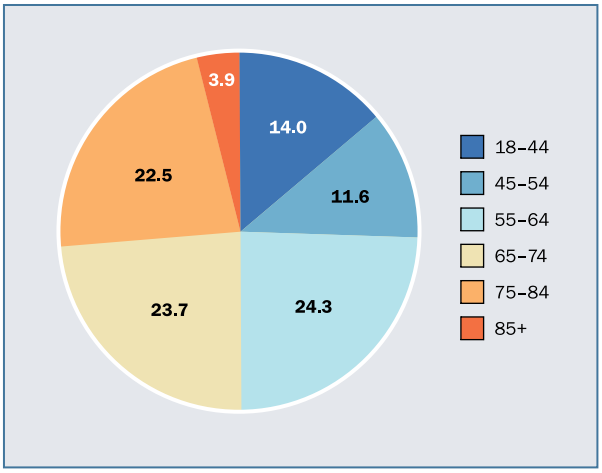

Figure 9. Pattern of registered incidence of diffuse large B-cell lymphomas according to age group

HMRN registry, and the PWG–InterLymph study [14–16]. This may be caused by insufficient quality of data reported by healthcare providers and the use of the ICD-10 C85 code for patients diagnosed with FL.

The median age of patients with FL calculated in the study was 62 years and this was similar to those reported

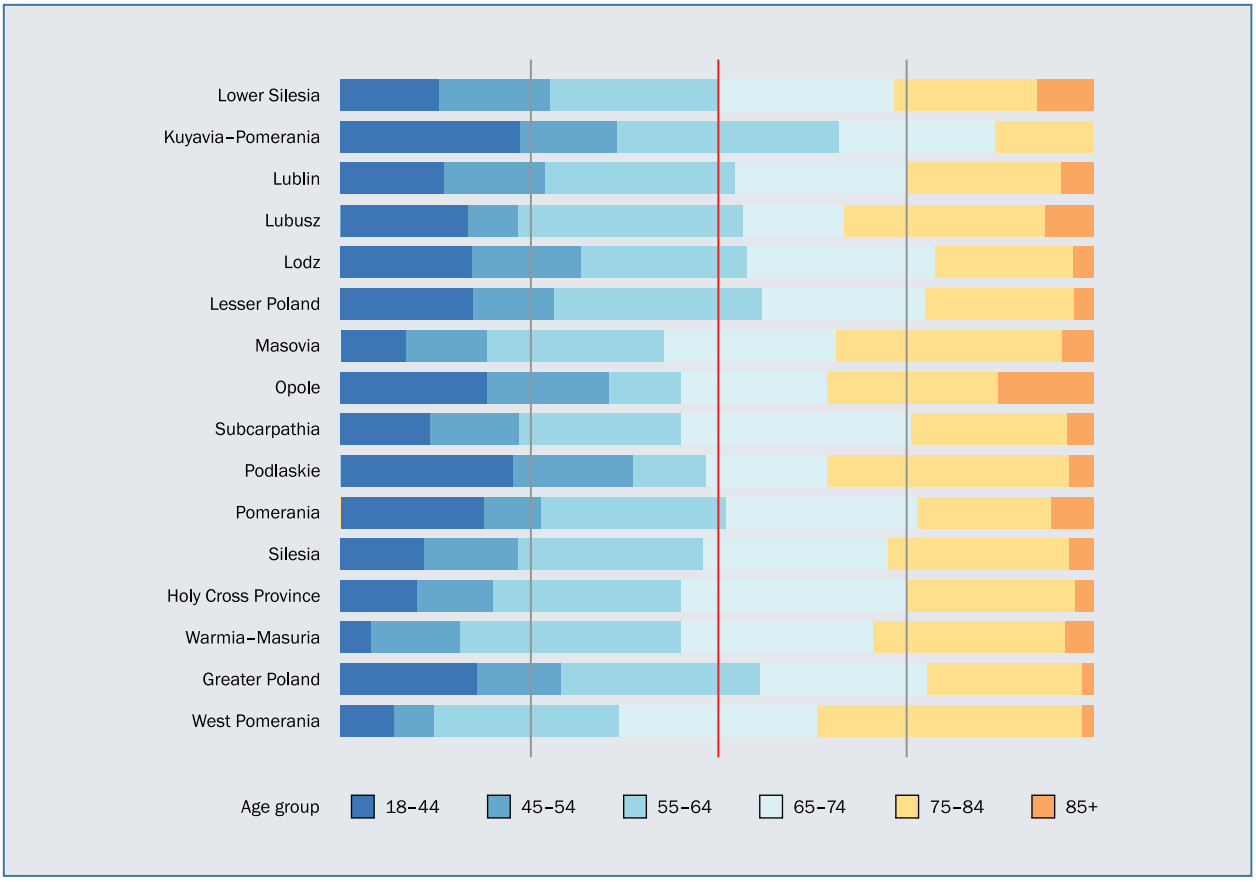

Figure 10. Pattern of registered incidence of diffuse large B-cell lymphomas according to age group and region of Poland

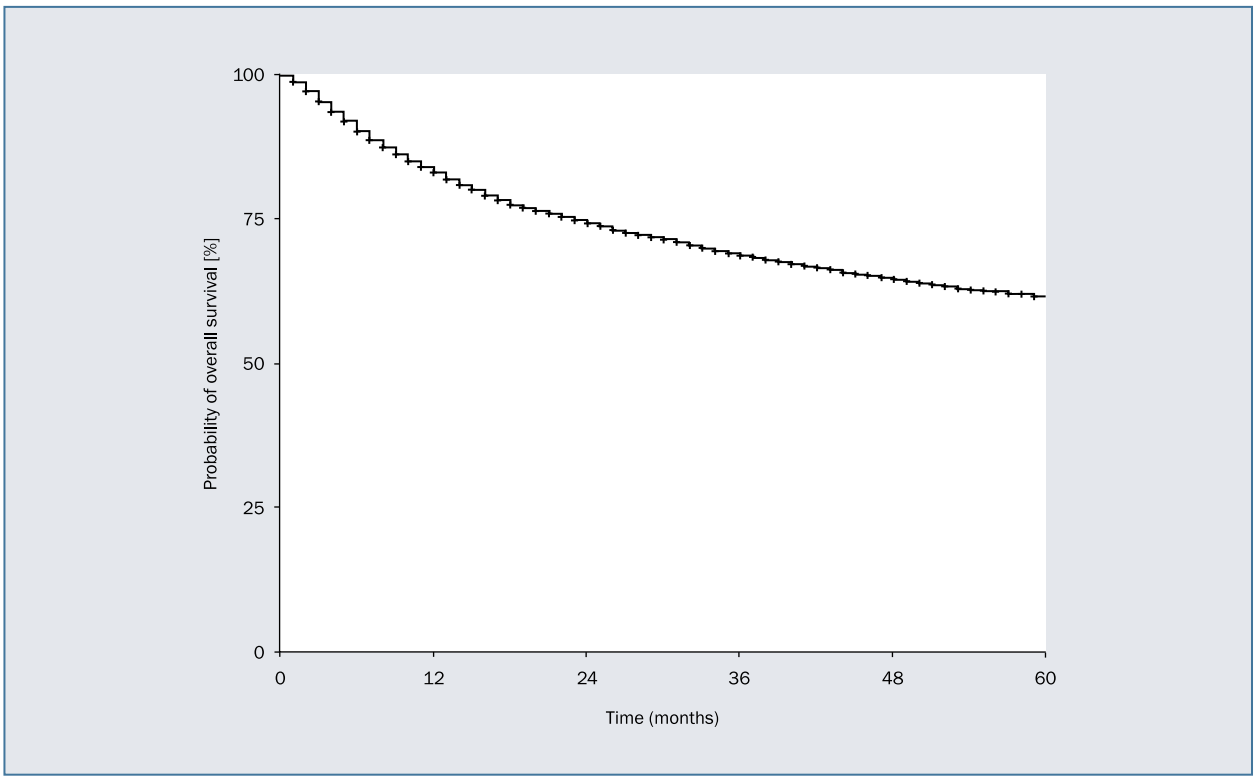

Figure 11. Probability of overall survival in patients registered with diffuse large B-cell lymphomas

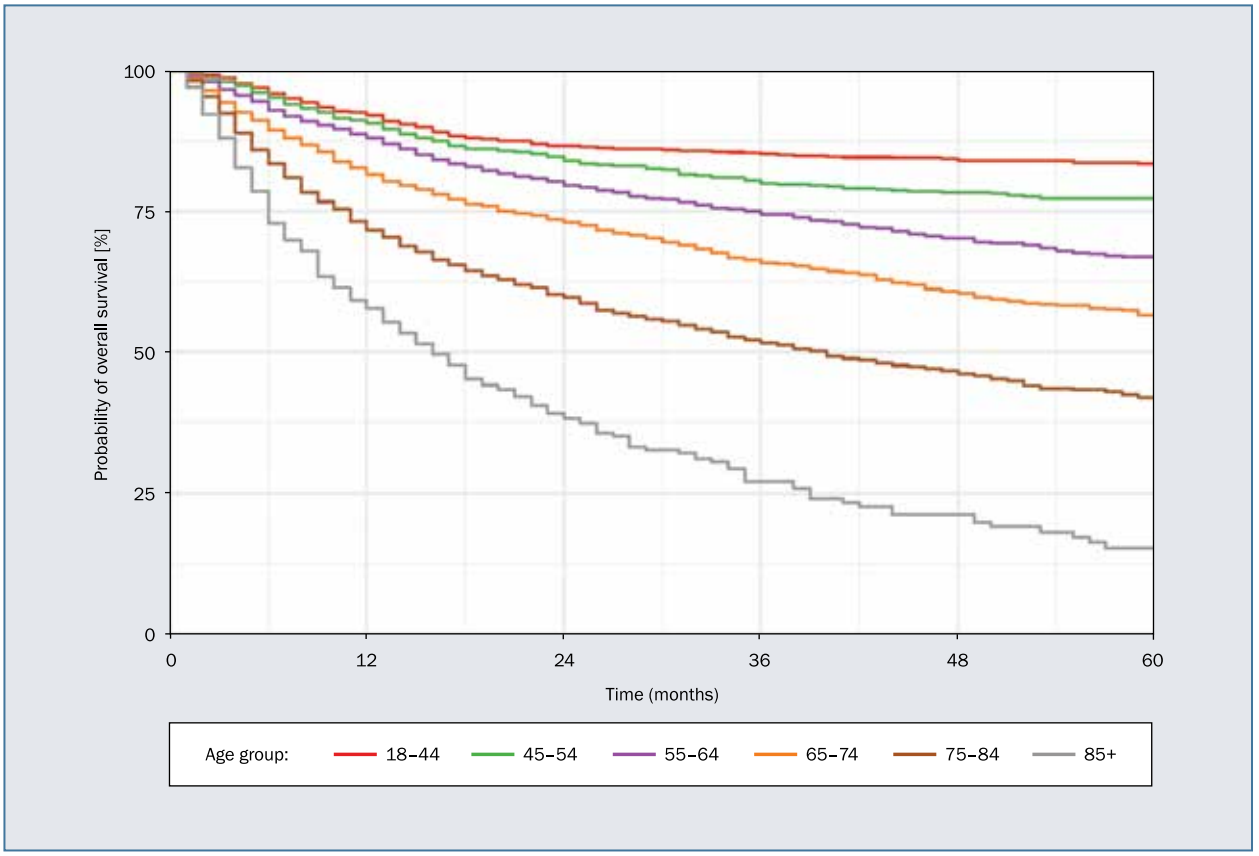

Figure 12. Probability of overall survival in patients registered with diffuse large B-cell lymphomas according to age group

Table IV. Estimated 3- and 5-year overall survival (OS) in patients registered with diffuse large B-cell lymphomas according to age group

Age group (years)	Median (months)	3-year OS (range)	5- year OS (range)
18–44	>60	85% (83–87%)	83% (80–85%)
45–54	>60	80% (77–82%)	77% (74–80%)
55–64	>60	75% (73–76%)	66% (64–69%)
65–74	>60	66% (64–68%)	56% (54–59%)
75–84	40	52% (49–54%)	41% (38–44%)
85+	16	27% (22–33%)	15% (11–22%)

Table V. Registered incidence and prevalence rates for chronic lymphocytic leukemia according to defined region of Poland

Province/country	Incidence per 100,000	Prevalence per 100,000
POLAND	**8.65**	**38.28**
Lower Silesia	6.84	45.23
Kuyavia–Pomerania	6.70	43.79
Lublin	6.75	43.96
Lubusz	4.22	23.53
Lodz	29.20	39.63
Lesser Poland	7.66	39.05
Masovia	6.90	37.44
Opole	8.00	45.99
Subcarpathia	5.78	35.56
Podlaskie	7.13	46.73
Pomerania	4.95	25.90
Silesia	12.48	35.23
Holy Cross Province	7.44	41.02
Warmia–Masuria	6.30	38.93
Greater Poland	5.30	36.87
West Pomerania	5.89	38.66

in other studies [15]. Unlike the majority of hematological neoplasms, in the group of patients diagnosed with FL there was a slight predominance of women (54%), similar to other registries [14, 15].

The probability of 5-year OS in patients registered in the NHF system using FL codes was 68.8%, slightly lower than the 5-year OS observed in the largest European study EUROCARE-5 covering data from 2006–2008, i.e. 74% [18], in the HMRN study 76% [15], or in the HAEMACARE study 72% [19]. According to unpublished NCR data, the probability of a 5-year OS in 2010–2014 was 85% and this was higher than the values observed in European studies [15, 18, 19]. These differences may result from the underestimated number of FL patients reported to the NCR by service providers.

Diffuse large B-cell lymphomas

The registered incidence of DLBCL estimated based on the analysis of services reported to the National Health Fund was 3.76/100,000/year, very close to the raw incidence rate in the HAEMACARE study of 3.81/100,000/year [14]. DLBCL incidence rates in the British HMRN registry and in the PWG–InterLymph study were higher: 8.31/100,000/year and 6.8/100,000/year, respectively [15, 16].

According to unpublished data of the NCR (data obtained courtesy of Prof. J. Didkowska as part of the cooperation in the above-mentioned project), the DLBCL incidence in Poland in 2010–2014 was 4.49/100,000/year, and this was similar to the registered incidence. As in the case of FL, the differences concerned the prevalence, which according to the NCR data was 15.58/100,000. The number of DLBCL patients in Poland was estimated at 5,992. The prevalence obtained based on analysis of services reported to the National Health Fund was 27.48/100,000 and this was comparable with the HMRN report, in which it was 25.9/100,000 [15].

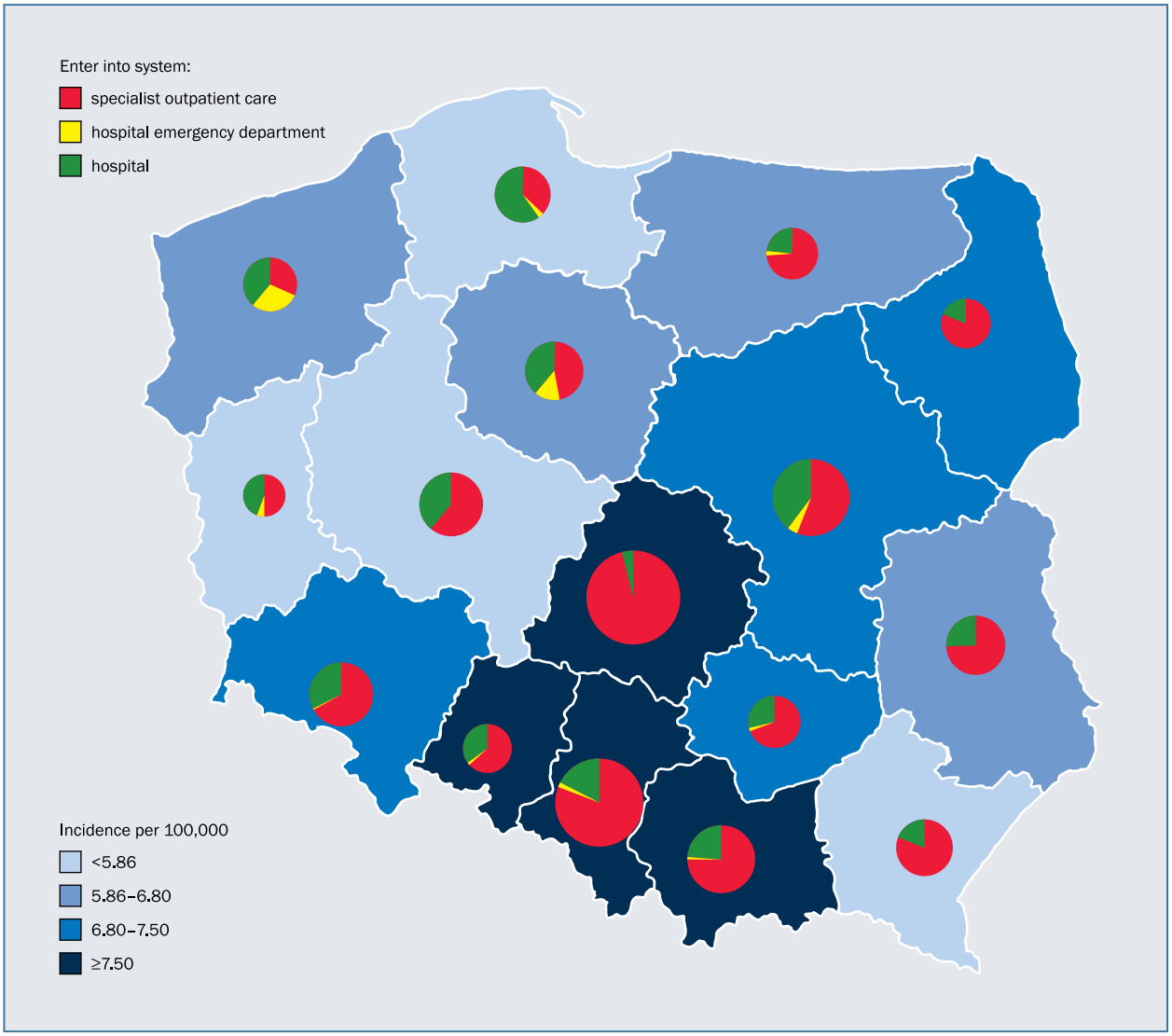

Figure 13. Registered incidence rate for chronic lymphocytic leukemia according to defined region of Poland

The median age of DLBCL patients in the present study was 65 years, compared to 70 years in the HMRN study [15]. In the group of patients diagnosed with DLBCL, women accounted for 51% and the gender distribution of DLBCL patients was similar to that observed in the HMRN and HAEMACARE registries [14, 15].

The probability of a 5-year OS in patients registered in the NHF system using DLBCL codes was 61.1% and this was higher than reported in the EUROCARE-5 study in 2006–2008, i.e. 55%, in the HMRN study 46%, and in the HAEMACARE study 49.3% [15, 18, 19]. According to unpublished NCR data, the probability of a 5-year OS in DLBCL patients in 2010–2014 was 70% and this was even higher than that reported in the present study and in European studies [14, 15]. The observed differences may result from the underestimated prevalence of DLBCL in the NCR.

Chronic lymphocytic leukemia

According to SEER NCI data, the incidence of CLL/SLL in the American population in 2010–2014 was 4.7/100,000/year, and the number of new cases in 2017 was estimated at 20,110 [1]. On the other hand, an analysis of epidemiological data in the HAEMACARE study showed that the raw incidence rate of CLL/SLL in Europe was 4.92/100,000/year (11,019 new cases) [14]. According to unpublished NCR data (data obtained courtesy of Prof. J. Didkowska as part of the cooperation in the above-mentioned project), the incidence of CLL/SLL in 2010–2014 was 3.93 (1,512 new cases), the number of patients with CLL/SLL in Poland was estimated at 5,850, and the prevalence was estimated at 15.21/100,000. For comparison, in the United Kingdom, 3,709 new cases of CLL were registered in 2015, and the prevalence at the end of 2010 was 20,200 patients [20].

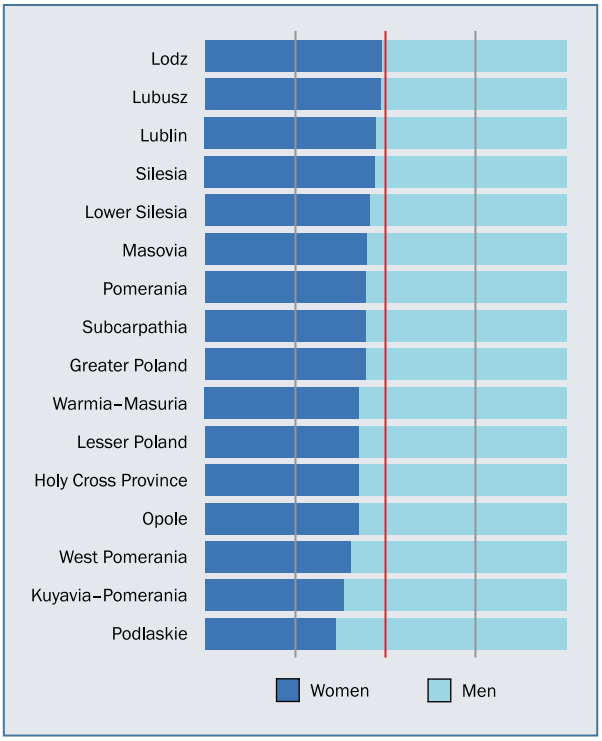

Figure 14. Pattern of registered incidence of chronic lymphocytic leukemia according to gender and region of Poland

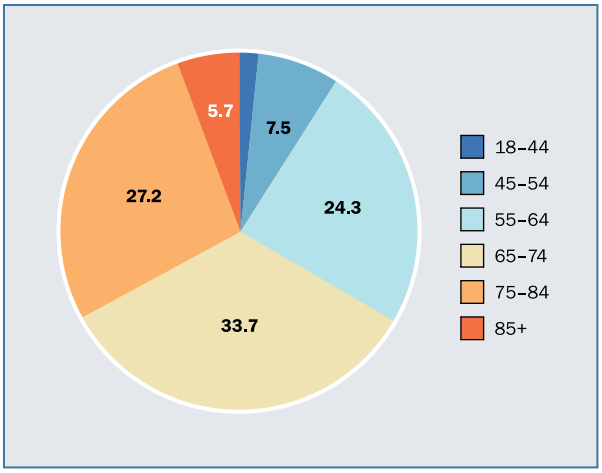

Figure 15. Pattern of registered incidence of chronic lymphocytic leukemia according to age group

The incidence (8.65/100,000/year) and prevalence (38.28/100,000) rates of CLL/SLL obtained in the presented study based on analysis of services reported to the National Health Fund could be considered to be overestimated compared to the above-cited epidemiological studies. This may be associated with a much higher incidence rate observed

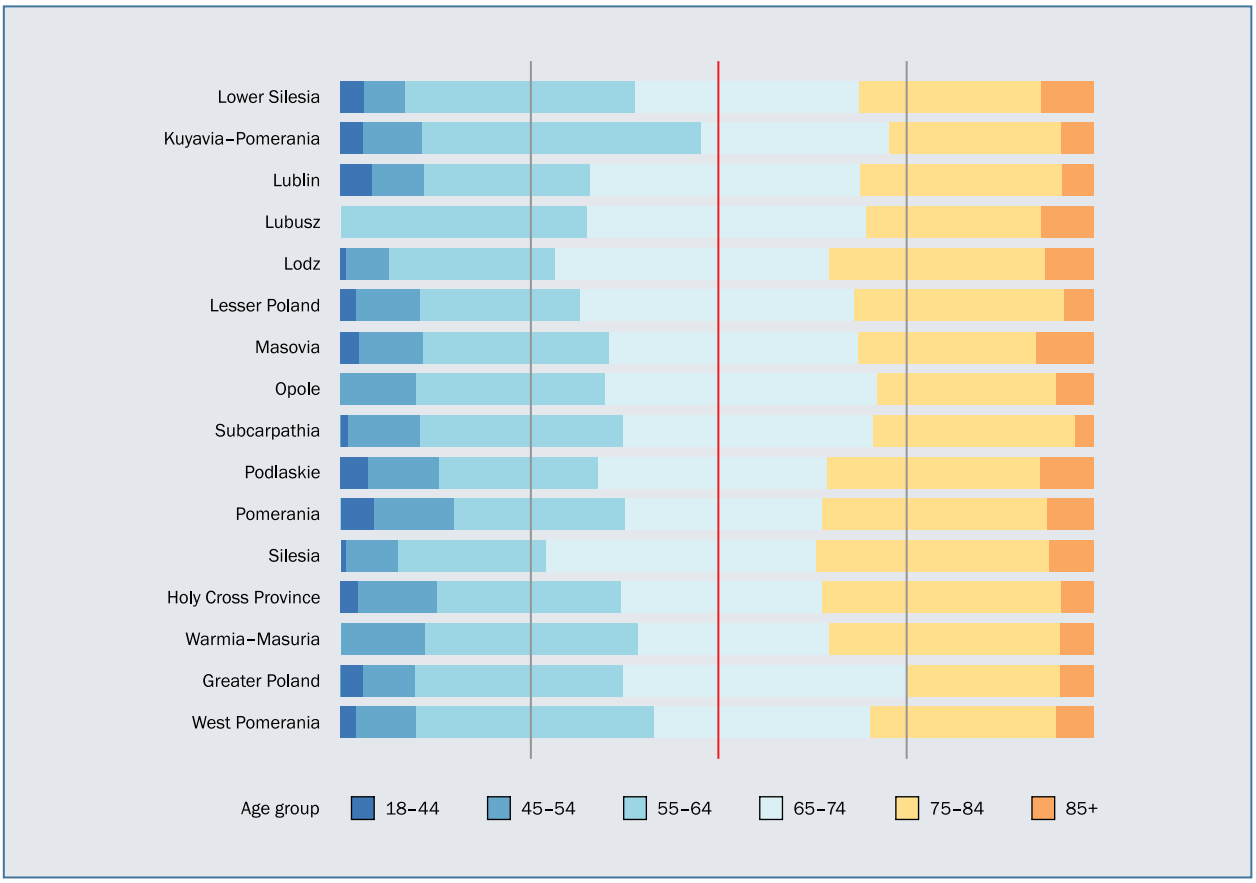

Figure 16. Pattern of registered incidence of chronic lymphocytic leukemia according to age group and region of Poland

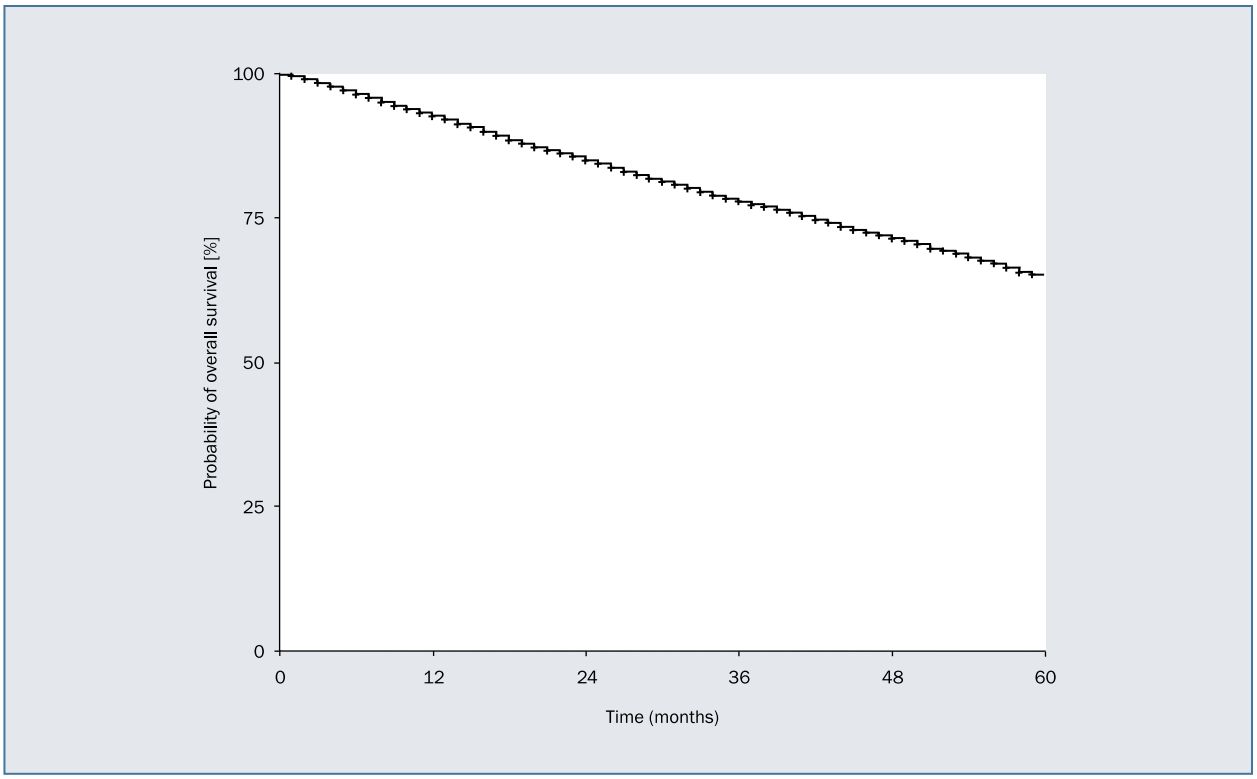

Figure 17. Probability of overall survival in patients registered with chronic lymphocytic leukemia

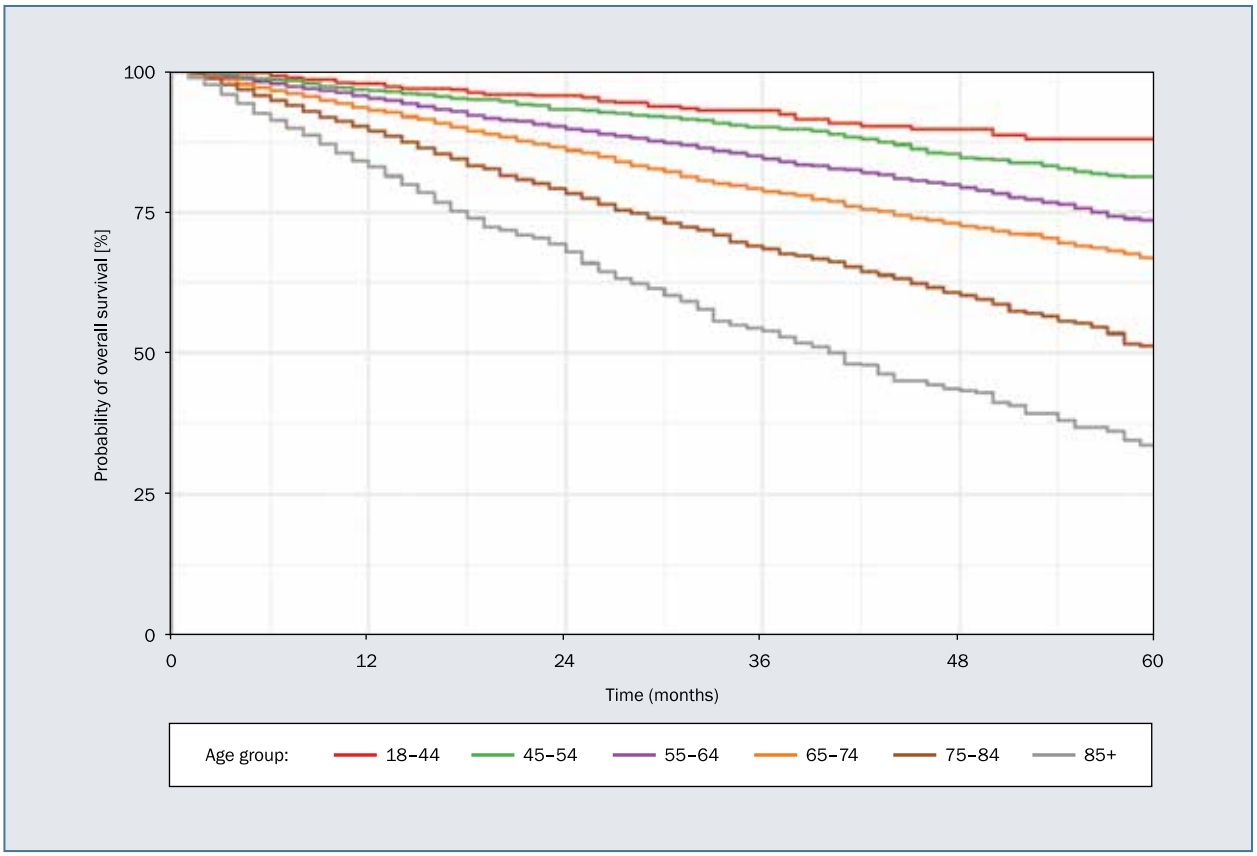

Figure 18. Probability of overall survival in patients registered with chronic lymphocytic leukemia according to age group

Table VI. Estimated 3- and 5-year overall survival (OS) in patients registered with chronic lymphocytic leukemia according to age group

Age group (years)	Median (months)	3-year OS (range)	5- year OS (range)
18–44	>60	93% (91–96%)	88% (84–92%)
45–54	>60	90% (88–92%)	81% (78–84%)
55–64	>60	85% (83–86%)	73% (71–75%)
65–74	>60	79% (77–80%)	67% (65–69%)
75–84	>60	68% (67–70%)	50% (48–53%)
85+	40	54% (50–58%)	33% (28–39%)

Table VII. Registered incidence and prevalence rates for plasma cell myeloma according to defined region of Poland

Province/country	Incidence per 100,000	Prevalence per 100,000
POLAND	**4.92**	**23.28**
Lower Silesia	5.74	26.66
Kuyavia–Pomerania	4.50	22.06
Lublin	4.75	21.05
Lubusz	4.31	21.47
Lodz	4.47	18.58
Lesser Poland	4.81	22.81
Masovia	6.84	32.10
Opole	4.50	23.99
Subcarpathia	4.56	21.75
Podlaskie	4.70	26.35
Pomerania	5.43	26.20
Silesia	4.71	23.23
Holy Cross Province	4.36	19.40
Warmia–Masuria	3.19	16.76
Greater Poland	4.03	18.49
West Pomerania	3.85	16.79

in the Lodz voivodeship (29.20/100,000/year) compared to other voivodeships (the range of differences between the values ranges from 2.3 to 6.9 times). The analysis of median age of CLL/SLL patients at diagnosis, the distribution of age groups, and death rates due to CLL/SLL in the Lodz voivodeship were comparable to values observed in other provinces. This would suggest that this difference may have resulted from the method of reporting data to the NHF.

The median age of CLL/SLL patients in Poland was 69 years, similar to that reported in other studies [1, 14, 20] with a slight predominance of men (55%), again similar to other registries [1, 14, 20].

The probability of a 5-year OS in patients registered in the NHF system with CLL/SLL code was 64.8% and this was comparable to those reported in other European countries. In the EUROCARE-5 study, the relative 5-year OS of CLL/SLL patients in 2006–2008 was 69%, similar to the HAEMACARE study [18, 19]. In turn, according to SEER data, the relative 5-year OS rate in 2007–2013 in CLL/SLL patients was 83% [1]. According to unpublished NCR data, the probability of a 5-year OS in CLL/SLL patients in Poland in 2010–2014 was 61%. It should be noted, however, that population indices define 'relative survival' as the ratio of the observed survival to the expected survival for all persons of a given age and gender in the studied population, which can differ from survival calculated with the use of the Kaplan-Meier method. The lower survival rates observed in the European population compared to the American population may be associated with limited or later access to new drugs, and/or differences in the frequency of diagnostic tests, especially in the elderly [18].

Plasma cell myeloma

Based on epidemiological data from 2010–2014 in the SEER NCI database, the incidence rate of PCM in the American population was 6.6/100,000/year. Based on

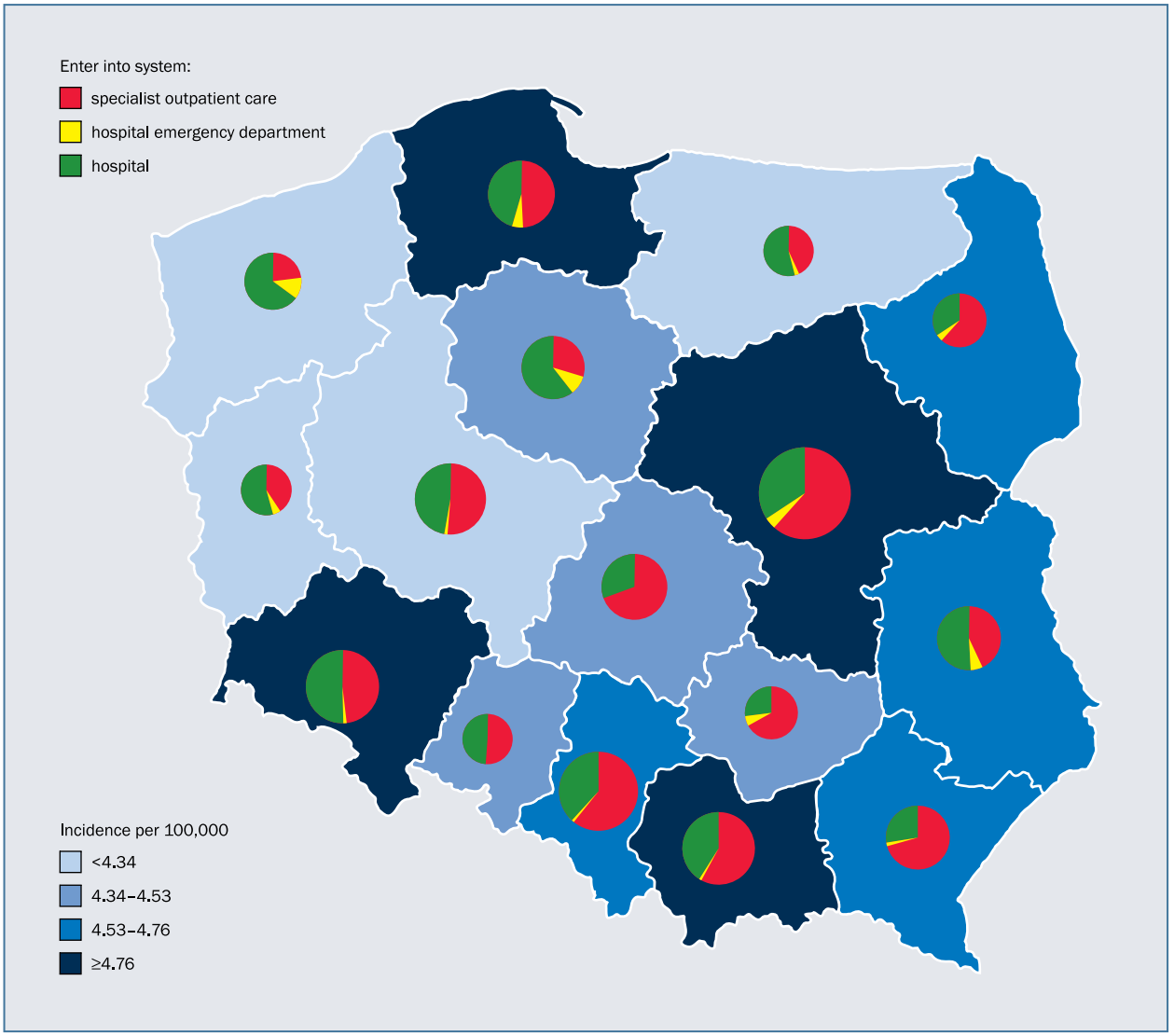

Figure 19. Registered incidence rate of plasma cell myeloma according to defined region of Poland

this, the estimated number of new cases in 2017 was 30,280 [1]. On the other hand, an analysis of the HAEMACARE study showed that the raw incidence rate of PCM in Europe was 5.44/100,000/year (12,192 new cases) [14].

According to unpublished NCR data (data obtained courtesy of Prof. J. Didkowska as part of the cooperation in the above-mentioned project), the incidence of PCM in Poland in 2010–2014 was 3.45 (1,327 new cases) and this was lower than the recorded incidence, i.e. 4.92/100,000/year. Similarly, the prevalence rate according to the NCR data (11.19/100,000) was half that of the registered prevalence rate (23.28/100,000). The incidence and the registered prevalence of PCM obtained in the presented study based on the analysis of services reported to the National Health Fund are similar to the epidemiological indices in British, German and American registers [4, 14, 16].

The median age of PCM patients was 67 years and this was similar to those reported in other studies [1, 14]. On the other hand, in the presented study, in patients reported with a diagnosis of PCM, there was a slight predominance of women (52%), in contrast to the HAEMACARE study, the SEER NCI registry, and the German registry, where more frequent PCM cases were in men [1, 4, 14].

The probability of 5-year OS in patients reporting to the National Health Fund using the PCM code was 49.7% and this was identical to the survival in 2007–2013 in the NCI SEER registry [1]. In the largest European study, EUROCARE-5, the relative 5-year OS of PCM patients in 2006–2008 was 64%, and in the HAEMACARE study in 2000–2002 it was 33% [14, 18]. The above differences between 5-year OS rates are most likely due to the much greater availability of new drugs used in the treatment of PCM patients over the last 10 years. In turn, according

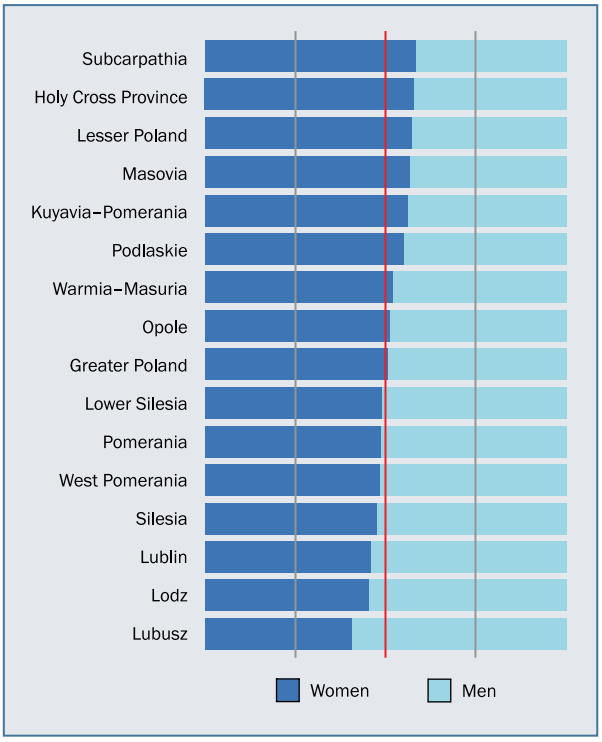

Figure 20. Pattern of registered incidence of plasma cell myeloma according to gender and region of Poland

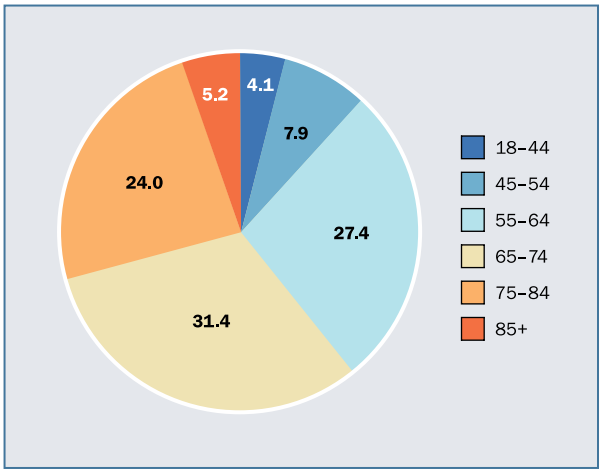

Figure 21. Pattern of registered incidence of plasma cell myeloma according to age group

to unpublished NCR data, the probability of 5-year OS of PCM patients in Poland in 2010–2014 was as high as 77%. The observed differences may result from a significant underestimation of the incidence and prevalence in the NCR data due to insufficient reporting by patient service providers.

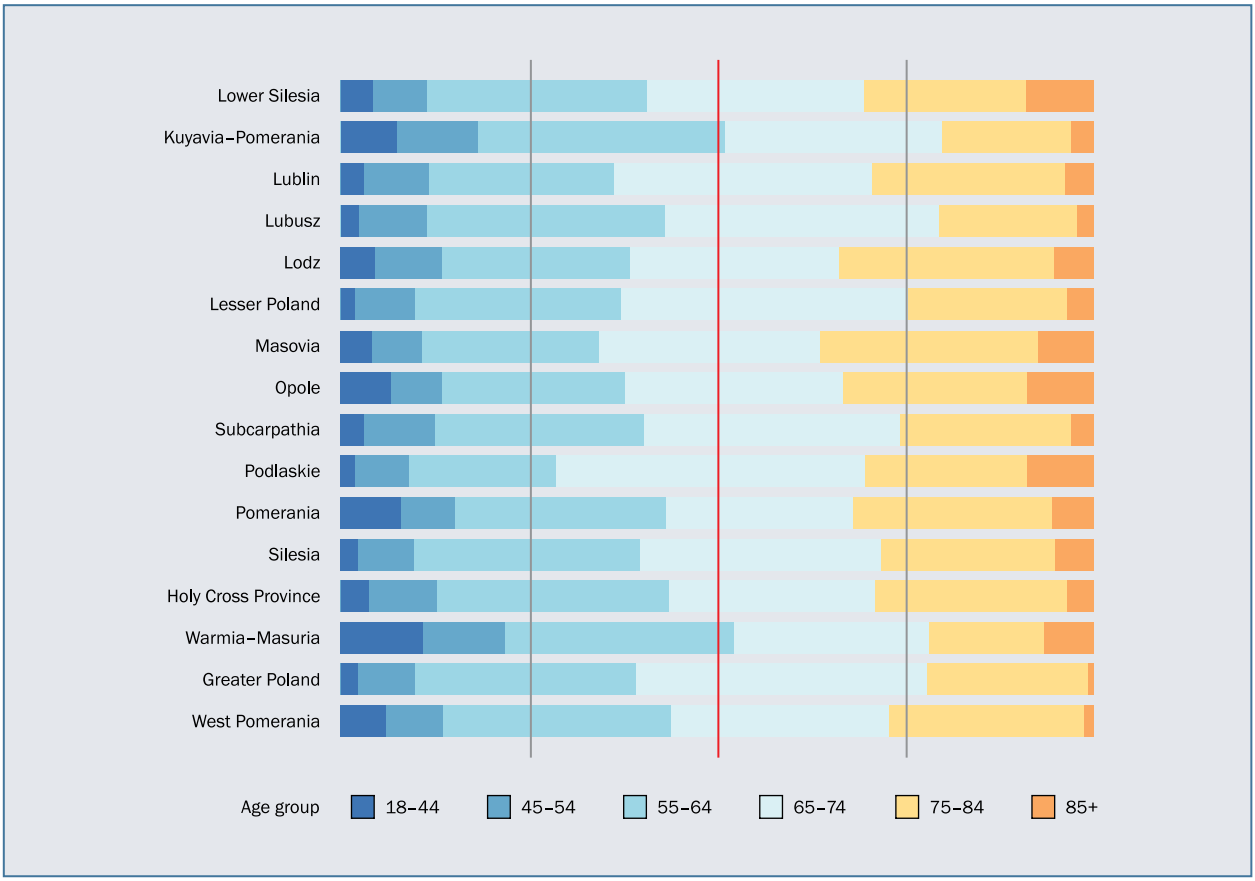

Figure 22. Pattern of registered incidence of plasma cell myeloma according to age group and region of Poland

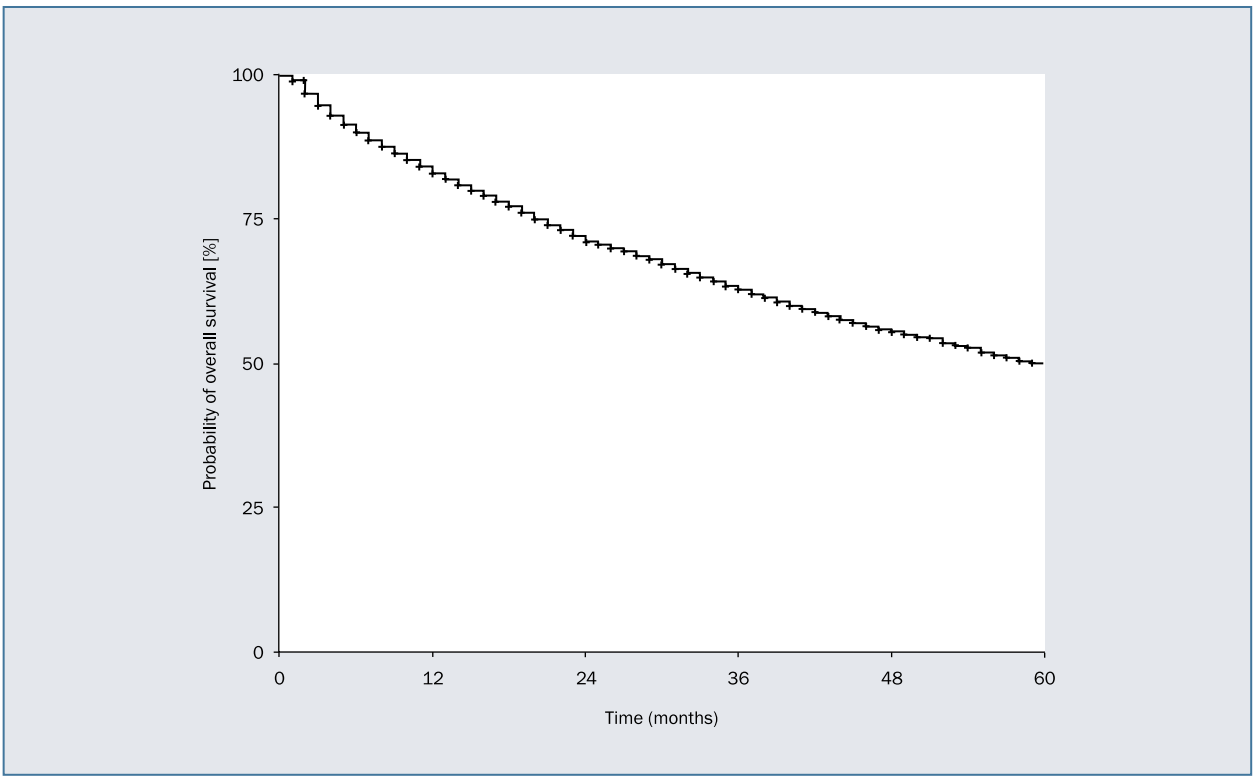

Figure 23. Probability of overall survival in patients registered with plasma cell myeloma

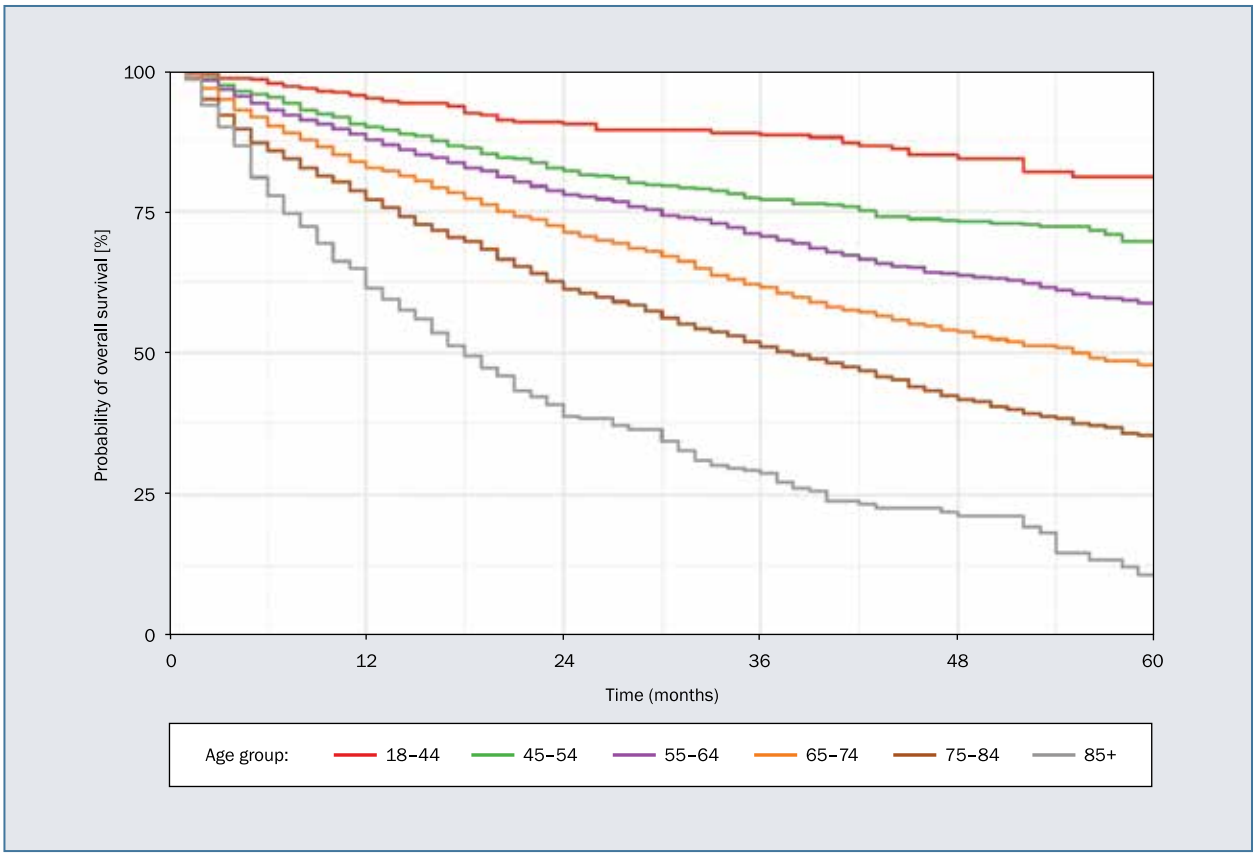

Figure 24. Probability of overall survival in patients registered with plasma cell myeloma according to age group

Table VIII. Estimated 3- and 5-year overall survival (OS) in patients registered with plasma cell myeloma according to age group

Age group (years)	Median (months)	3-year OS (range)	5- year OS (range)
18–44	>60	89% (85–92%)	81% (76–86%)
45–54	>60	77% (74–80%)	70% (66–74%)
55–64	>60	71% (69–72%)	58% (56–61%)
65–74	56	62% (60–64%)	48% (45–50%)
75–84	38	51% (49–53%)	35% (32–38%)
85+	18	29% (24–34%)	11% (7–18%)

Conclusions

The incidence and prevalence rates presented in this study for the four most common lymphatic neoplasms are based on data reported to the National Health Fund in order to obtain reimbursement of services, and therefore seem to be the most reliable data covering such a large population of patients. It should also be emphasized that this is some of the first data on the prevalence of FL, DLBCL, CLL and PCM in Poland. Despite the fact that the data reported to the National Health Fund may be affected by errors (resulting from the insufficient quality of the cancer coding system and the failure to adapt the 10th Revision of the ICD-10 to the obligatory WHO classifications), it is similar to the data from European and American registries in relation to DLBCL and PCM, whilst the FL-related data seems to be underestimated. However, with regard to the incidence of CLL, the presented data requires further verification, in particular in Lodz voivodeship, where the incidence rate differs by several magnitudes from the value for the entire country.

Nevertheless, the presented results reflect the actual burden of lymphatic neoplastic diseases on the Polish healthcare system, and this is their most important value. Better understanding of the incidence, prevalence and overall survival of patients with hematological malignancies is important not only for clinical and scientific purposes, but could also be an important element influencing the organization of hematooncology care in Poland.

Authors' contributions

ELM, BKB — were responsible for the conception and design of the study, analysis and interpretation of data, writing the manuscript, critical manuscript revision, and proofreading; TM, BW, JD — were responsible for big data techniques, economic, financial, and statistical analysis, and critical manuscript revision; WWJ — was responsible for the conception of the study, analysis and interpretation of data, and critical manuscript revision.

Conflict of interest

The authors have no conflict of interest to declare.

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Ethics

The work described in this article has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans; EU Directive 2010/63/EU for animal experiments; Uniform requirements for manuscripts submitted to biomedical journals.

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