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Lung cancer in Podkarpackie region in the years 2002–2011

Rak płuca w województwie podkarpackim w latach 2002–2011

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Abstract

Introduction: Lung cancer is one of the greatest challenges for modern medicine and in Poland the incidence and mortality rate are one of the highest.

The aim of the study was to assess trends in the incidence and mortality rate lung cancer in the Podkarpackie province in the years 2002–2011.

Material and methods: 9993 cases (8018 men and 1975 women) and 8782 deaths (7211 men and 1571 women) of lung cancer were analyzed. Crude rate and standardized coefficients of incidence and mortality as well as stratum weight, and cumulative risk of incidence and mortality were calculated.

Results: In 2011, in Podkarpackie province a decrease number of lung cancer cases in men was observed compared to 2002 amounting to 195 case, but in women, an increase of 39 new cases was noted. Incidence rates in men were in the range of 65.8–93.1/100 000, while in women they ranged 9.6–35.2/100 000. Mortality rates for males ranged from 59.2 to 82.8/100 000, and in women from 6.1 to 29.0/100 000. Considerable diversity in incidence and mortality in different districts of the province of Podkarpackie was observed.

Conclusions: In the years 2002–2011 the values of incidence and mortality rates for men in Podkarpackie province were lower than the rates for Poland, in case of women the same rates for Podkarpackie were almost two times lower than the rates for Poland. In the years 2002–2011 the highest value of incidence and mortality rate out of all districts of Podkarpackie Province was observed in the district Lubaczów for men and in Przemyśl in case of women.

Key words: lung cancer, incidence rate, mortality rate

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Streszczenie

Wstęp: Rak płuca jest jednym z największych wyzwań współczesnej medycyny, a Polska należy do krajów o największej zapadalności i umieralności z powodu tego nowotworu.

Celem pracy była ocena trendów zachorowalności i umieralności na raka płuca w województwie podkarpackim w latach 2002–2011.

Materiał i metody: Analizie poddano 9993 zachorowań (8018 u mężczyzn i 1975 u kobiet) i 8782 zgonów (7211 u mężczyzn i 1571 u kobiet) z powodu raka płuca. Zostały obliczone współczynniki surowe i standaryzowane zachorowalności i umieralności, wskaźniki struktury oraz ryzyko skumulowane zachorowania i zgonu.

Wyniki: W 2011 roku w województwie podkarpackim zanotowano w porównaniu z rokiem 2002 spadek liczby zachorowań u mężczyzn o 195 nowych przypadków, natomiast u kobiet nastąpił wzrost o 39 nowych zachorowań. Współczynniki zachorowalności u mężczyzn wahały się w przedziale 65,8–93,1/100 000, natomiast u kobiet w przedziale 9,6–35,2/100 000. Współczynniki umieralności dla mężczyzn wynosiły od 59,2 do 82,8/100 000, a u kobiet od 6,1 do 29,0/100 000.

Zaobserwowano duże zróżnicowanie zachorowalności i umieralności w poszczególnych powiatach województwa podkarpackiego.

Wnioski: W latach 2002–2011 w województwie podkarpackim współczynniki zachorowalności i umieralności dla mężczyzn przyjmowały wartości niższe niż współczynniki w tym samym czasie dla Polski, a u kobiet te same współczynniki dla wojewódz-

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twa podkarpackiego przyjmowały wartości prawie dwukrotnie niższe niż wartości współczynników dla Polski. W powiatach województwa podkarpackiego w latach 2002–2011 największą wartość współczynnika zachorowalności i umieralności dla mężczyzn zaobserwowano w powiecie lubaczowskim, a u kobiet w mieście Przemysłu.

Słowa kluczowe: rak płuca, zachorowalność, umieralność

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Introduction

Lung cancer is one of the biggest challenges for contemporary medicine. It affects epidemiological, diagnostic and therapeutic issues [1]. According to estimated data prepared by the IARC (International Agency for Research on Cancer) in 2012, there were approximately 1.8 million new registered cases of lung cancer incidence, and 58% of them concerned less developed countries. The highest incidence among men (1.2 million) was noted in Central and Eastern Europe and Eastern Asia. Particularly low incidence rates were observed in Central (2.0/100 000) and Western Africa (1.7/100 000). Among women, the highest incidence was noted in North America (33.8/100 000), Northern Europe (23.7/100 000) and Eastern Asia (19.2/100 000). The lowest incidence among women was observed in West Africa and Middle East (1.1/100 000 and 0.8/100 000 respectively) [2]. Lung cancer is the most frequent cause of cancer deaths worldwide. Estimated data indicate that in 2012, there were approximately 1.6 million deaths and lung cancer constituted 19.4% among all cancers [3]. While comparing incidence and

mortality worldwide, it can be noticed that the highest incidence and mortality occur in the same regions of the world.

Poland belongs to the countries with the highest standardised ratio, both of incidence (33.4/100 000) and mortality (38.0/100 000). In Europe, higher coefficients belong only to Serbia (incidence — 39.1/100 000 and mortality — 45.6/100 000), and Hungary (43.3/100 000 and 51.6/100 000 respectively) [2]. About 20 000 new cases and 22 000 deaths due to lung cancer are registered in Poland every year (Tables 1, 2). Over the discussed decade, the incidence rate increased in total by 6.4%, including the decrease in men by 4.3% and increase in women by as much as 43.4%. The decrease was also noted in respect to crude and standardised rates in men — respectively 81.9/100 000 and 63.0/100 000 in 2002, and 77.9/100 000 and 50.0/100 000 in 2011. Whereas in women, the rates increased markedly, and in 2002 crude and standardised rates reached the value of 22.2/100 000 and 13.8/100 000 respectively, and in 2011, they amounted to 31.6/100 000 and 17.3/100 000 (Table 1).

Table 1. Registered new cancer cases and lung cancer incidence in Poland between 2002–2011 [4]

Incidence males				Year	Incidence females			
Registered new cancer cases	Crude rate per 100 000	Standardized rate	Cumulative risk %		Registered new cancer cases	Crude rate per 100 000	Standardized rate	Cumulative risk %
149852				2002–2011	52433			
15173	81.9	63.0	8.0	2002	4380	22.2	13.8	1.7
15762	85.2	64.1	8.1	2003	4781	24.3	14.8	1.8
15704	85.0	62.9	7.9	2004	4610	23.4	13.9	1.7
15248	82.6	60.0	7.6	2005	4797	24.4	14.4	1.8
15157	82.2	58.5	7.4	2006	5075	25.8	15.1	1.8
14659	79.6	55.4	7.0	2007	5250	26.7	15.5	1.9
14130	76.8	52.2	6.6	2008	5319	27.0	15.4	1.9
14703	79.8	53.3	6.8	2009	5900	29.9	16.7	2.1
14794	79.3	52.2	6.7	2010	6038	30.4	16.9	2.2
14522	77.9	50.0	6.4	2011	6283	31.6	17.3	2.2

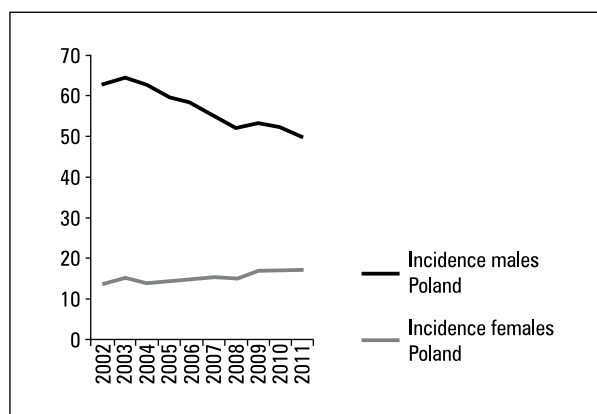


Figure 1. Lung cancer incidence in Poland between 2002–2011, standardised rates

In Poland, different trends in lung cancer incidence for men and women have been observed. After 2003, a significant decrease in crude and standardised incidence rates has been observed in men. Whereas in women, after 2004, rates have been on the increase (Table 1, Fig. 1).

Lung cancer is the first cause of all cancer deaths, both in men and women. In men, it constitutes approximately 31% of all deaths due to cancer, whereas in women, about 16%. In men, the number of deaths decreased by 728 cases (4.4%). A downward trend is also reflected by crude and standardised mortality rates. Crude rates amounted to 90.1/100 000 in 2002, and to 85.6/100 000 in 2011, and standardised rates reached 68.6/100 000 and 54.1/100 000 respectively. Whereas in women, an upward trend has been observed.

In 2002, crude and standardised mortality rates amounted to 22.9/100 000 and 13.6/100 000 respectively, and in 2011, to 31.5/100 000 and 16.2/100 000 (Table 2).

The most known risk factor of lung cancer is tobacco smoking. It is believed that over 90% of cases is related to carcinogenic effect of tobacco smoke. It is estimated that currently, 29% of adults, i.e. approximately 9 million Poles smoke cigarettes [5]. It has been proved that increased cigarette smoking brings closer the risk of lung cancer incidence on average by 20–30 years, and that tobacco smokers constitute 91% in men and approximately 70% in women suffering from lung cancer [6]. In recent years, a significant increase in incidence among women has been noted, which is related to the number of the cigarettes smoked. Passive smoking also poses a serious social problem. According to the WHO and the Ministry of Health, 19% of non-smoking Poles (24% of men and 14% of women) are exposed to tobacco smoke in their workplace. At home, passive smoking affects 25% of inhabitants of Poland (20% of non-smoking men and 29% of non-smoking women) [7].

It is believed that occupational exposure to carcinogenic factors is responsible for about 9–15% of new diagnoses of lung cancer. The factors that determine the occurrence of the disease are asbestos and ionizing radiation [8, 9]. Inhaling asbestos dust may cause lung cancer and mesothelioma of the pleura [8]. Occupational conditions that raise the risk of lung cancer occurrence also include long-lasting exposure to diesel

Table 2. Lung cancer mortality in Poland between 2002–2011 [4]

Death males				Year	Death females			
Death	Crude rate per 100 000	Standardized rate	Cumulative risk %		Death	Crude rate per 100 000	Standardized rate	Cumulative risk %
164571				2002–2011	53411			
16689	90.1	68.6	8.6	2002	4519	22.9	13.6	1.6
16301	88.2	66.0	8.3	2003	4688	23.8	13.9	1.7
16523	89.4	65.5	8.3	2004	4627	23.5	13.4	1.6
16522	89.5	64.4	8.1	2005	4933	25.0	14.2	1.7
16623	90.2	63.6	8.0	2006	5108	25.9	14.5	1.8
16556	89.9	61.7	7.8	2007	5552	28.2	15.5	1.9
16855	91.6	61.4	7.6	2008	5623	28.5	15.5	1.9
16354	88.8	58.3	7.3	2009	5945	30.1	16.0	2.0
16187	86.8	56.2	7.0	2010	6161	31.0	16.3	2.1
15961	85.6	54.1	6.7	2011	6255	31.5	16.2	2.1

emissions and chemical factors accompanying the manufacture of rubber tyres. In 1982, the IARC recognised rubber industry as carcinogenic to humans [10]. It is believed that air pollution, including polycyclic aromatic hydrocarbons and its derivatives induce approximately 1–2% of lung cancer cases annually. The studies conducted in the 1980s showed disadvantageous influence of saturated fat-rich diet, alcohol abuse and excessive beta-carotene supplementation on lung cancer development [11].

Primary prevention, i.e. combatting tobacco consumption is the most crucial tool to fight lung cancer incidence and mortality. It allows to undertake activities that may prevent lung cancer occurrence. In Poland, since 2006 the Program on Primary Prevention being the part of the National Program Against Cancer Diseases has been implemented. The program is fulfilled through regional Primary Prevention Offices, which have undertaken various activities aiming to promote pro-health education in the medical settings and socio-occupational groups (medical universities, social organisations, adults, children and youngsters). The effects of these activities include consolidation of healthy lifestyle patterns and prevention of unfavourable behaviour towards healthy persons [7]. Secondary prevention, i.e. preventive examinations of healthy individuals who belong to a high risk group, is the second most important tool that allows to detect lung cancer at early stage of development. The first screening test for early detection of lung cancer began in 1957 in Czechoslovakia. It consisted of radiological and cytological examinations performed every 6 months in smoking men aged 40–64 [12]. The researches carried out in the 1960s and 1970s (Memorial Sloan Kettering Lung Project, Johns Hopkins Lung Project, The Mayo Lung Program) also based on radiological and cytological examinations. They differed only in age of the subjects and the frequency of examinations [13]. But these measures turned out to be ineffective in early detection of the disease [14].

New possibilities appeared together with introduction of spiral computed tomography. It is very sensitive examination that uses a low exposure dose, therefore it is acceptable in terms of radiological protection and safety of screening test [13]. Since 1992 the studies on the use of low-dose computed tomography (LDCT), which is an efficient tool for screening among long-term habitual tobacco smokers have been conducted [15]. In Poland, pilot studies have been already carried out in Szczecin, Gdańsk and Warsaw, where in

total more than 30,000 persons from high risk groups have been examined. The results of the studies have shown explicitly an increased detection of lung cancer at early stage of development, whereas no impact of the examination was found on the decrease in mortality [13, 16].

The objective of the study was to analyse incidence and mortality of malignant lung cancer in women and men in the Podkarpackie province in the years 2002–2011.

Material and methods

Material for the study was obtained from the Podkarpackie Cancer Registry in Rzeszów.

Epidemiological analysis concerned 9993 cases (8018 men and 1975 women) and 8782 deaths (7211 men and 1571 women) due to malignant lung cancer in the Podkarpackie province in the years 2002–2011. The following indices were calculated: crude and standardised rates of incidence and mortality, stratum weights, cumulative risk of incidence and deaths and the proportion of lung cancer among malignant cancers. To calculate crude rates, demographic tables prepared by the Central Statistical Office (*Główny Urząd Statystyczny, GUS*) were used. For standardised rates, “standard world population” was assumed as population, as proposed by Segi and modified by Doll. Statistical analysis was made using Microsoft Excell 2010. The maps were made with the help of the Map Viewer 7.

Results

Lung cancer incidence

The number of registered new cases of malignant lung cancer in total was equal to 886 in 2011, and it was 14.9% lower than in 2002. In the discussed period, the decrease in incidence by 22.4% in men was observed, and a simultaneous increase by 22.5% in first diagnosis in women was noted.

In the analysed period, a significant decrease in crude and standardised rates of incidence in men was noticed. Crude rate amounted to 83.9/100 000 in 2002, and to 64.7/100 000 in 2011. Whereas standardised rate was equal to 67.8/100 000 in 2002, and 43.6/100 000 in 2011. While in the female population, incidence rate increased. Crude rate was 16.0/100 000 in 2002, and 19.5/100 000 in 2011. Similarly dynamic were standardised incidence rates, in 2002 — 9.9/100 000, and in 2011 — 11.8/100 000 (Fig. 2, Table 3).

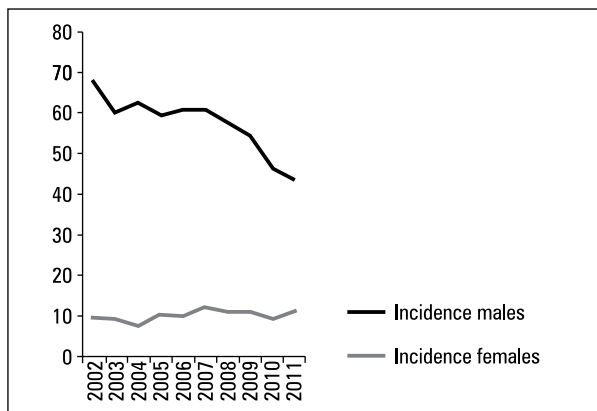


Figure 2. Lung cancer incidence in the Podkarpackie province between 2002–2011, standardized rates

The proportion of malignant lung cancers among all cancers in men decreased by 6.2%, whereas in women it increased by 1.9%. In men, cumulative risk of incidence also decreased from 7.9 in 2002 to 5.7 in 2011, and in women, it increased from 1.1 in 2002 to 1.5 in 2011 (Table 3).

The highest incidence was observed in men aged 65+, both in 2002 and 2011. In the study group, the highest decrease in incidence was observed in 2011 (405.1/100 000), compared to 2002 (495.1/100 000). The peak of incidence, in 2002, occurred in the 9th decade of life, and in 2011, in the 8th decade of life (Fig. 3).

In women, during the study period, the highest incidence rates were also found in the group

Table 3. Registered new cancer cases and lung cancer incidence in the Podkarpackie province between 2002–2011

Incidence males					Year	Incidence females				
Registered new cancer cases	Crude rate per 100 000	Standardized rate	%Percentage	Cumulative risk %		Cancer cases	Crude rate per 100 000	Standardized rate	Percentage	Cumulative risk %
8018	–	–	–	–	2002–2011	1975	–	–	–	–
869	83.9	67.8	23.9	7.9	2002	173	16.0	9.9	5.7	1.1
778	75.5	59.9	20.4	7.5	2003	167	15.5	10.0	5.3	1.1
823	79.8	62.5	23.1	7.7	2004	157	14.6	8.8	5.3	1.1
813	78.9	59.6	21.3	7.5	2005	188	17.5	10.5	5.8	1.2
834	81.0	60.7	22.0	7.4	2006	203	18.9	10.9	6.1	1.3
867	84.2	60.6	23.1	7.4	2007	232	21.6	12.4	6.9	1.5
854	83.0	58.2	22.4	6.9	2008	216	20.1	11.3	6.2	1.4
811	78.7	54.7	20.7	6.7	2009	232	21.5	11.0	6.8	1.3
695	66.8	46.7	17.8	6.0	2010	195	18.0	10.2	5.6	1.2
674	64.7	43.6	17.7	5.7	2011	212	19.5	11.8	6.1	1.5

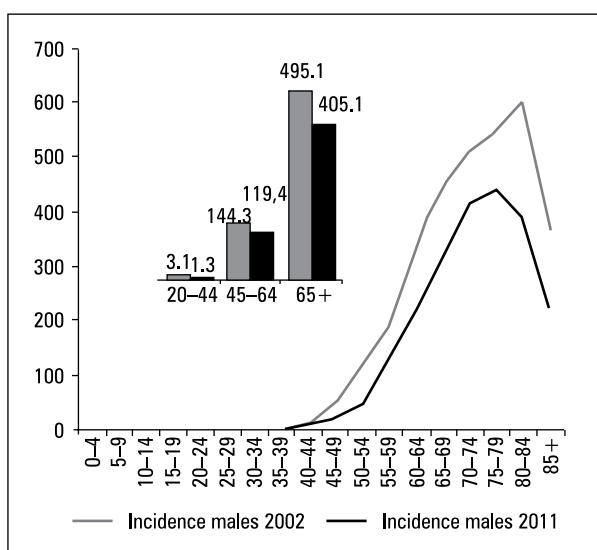


Figure 3. Lung cancer incidence by age groups in the Podkarpackie province between 2002–2011, males

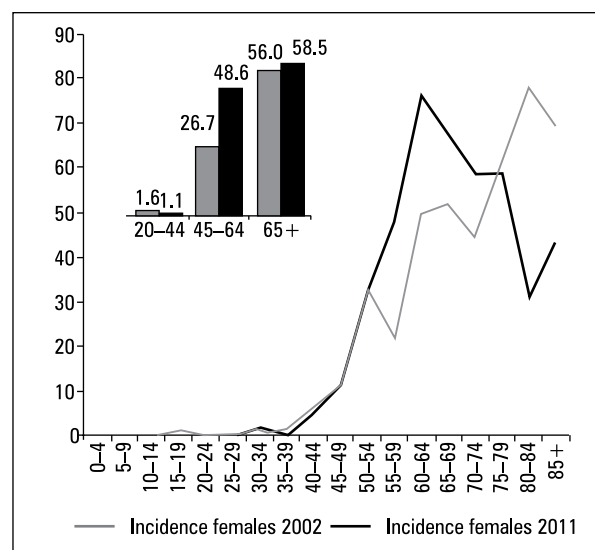


Figure 4. Lung cancer incidence by age groups in the Podkarpackie province between 2002–2011, females

aged 65+. In 2002, it amounted to 56.0/100 000, and in 2011, to 58.5/100 000. While in the male population, the decrease in incidence was visible in all discussed age groups; in the female population, a slight decrease in incidence rates was noted in the group aged 20–44 years, whereas in the group aged 45–64 years, a considerable increase in incidence was observed (by 82.5%). During the analysis of peak of incidence in women in the years 2002 and 2011, it was found that the peak in 2011 occurred two decades earlier than in 2002 (Fig. 4).

While investigating the occurrence of lung cancer in the Podkarpackie province, incidence in particular districts was thoroughly analysed. In the Podkarpackie province, there is a huge diversity of incidence. In the discussed period, the highest incidence rates in men were noted in the lubaczowski district — 93.1/100 000, strzyżowski — 86.4/100 000, brzozowski — 84.3/100 000 and in the town of Przemyśl — 84.1/100 000. Whereas the lowest incidence was observed in the łańcucki district — 65.8/100 000, in the city of Rzeszów — 66.8/100 000, the leski district — 66.9/100 000 and rzeszowski — 70.5/100 000. In women, the highest incidence was observed in the town of Przemyśl — 35.2/100 000, the leski district — 27.5/100 000, bieszczadzki — 27.3/100 000 and in the town of Krosno — 26.5/100 000. The lowest incidence was observed in the kolbuszowski district — 9.6/100 000, ropczycko-sędziszowski — 10.7/100 000, łańcucki — 11.7/100 000 and przeworski — 12.6/100 000 (Table 4, Figs 5, 6).

Table 4. Lung cancer incidence in the Podkarpackie province between 2002–2011 by districts, crude rate

District	Incidence males	Incidence females
bieszczadzki	64.3	27.3
brzozowski	84.3	15.2
dębicki	80.5	19.5
jarosławski	83.6	17.1
jasielski	78.8	17.9
kolbuszowski	83.8	9.6
krośnieński	81.1	14.9
leżajski	78.0	15.5
lubaczowski	93.1	15.0
łańcucki	65.8	11.7
mielecki	79.3	19.3
nizański	79.1	13.5
przemyski	82.0	22.1
przeworski	71.5	12.6
ropczycko-sędziszowski	75.6	10.7
rzeszowski	70.5	12.8
sanocki	65.3	15.5
stalowowolski	78.3	20.7
strzyżowski	86.4	15.2
tarnobrzegi	71.0	16.7
leski	66.9	27.5
m. Krosno	71.8	26.5
m. Przemyśl	84.1	35.2
m. Rzeszów	66.8	24.1
m. Tarnobrzeg	75.5	25.1

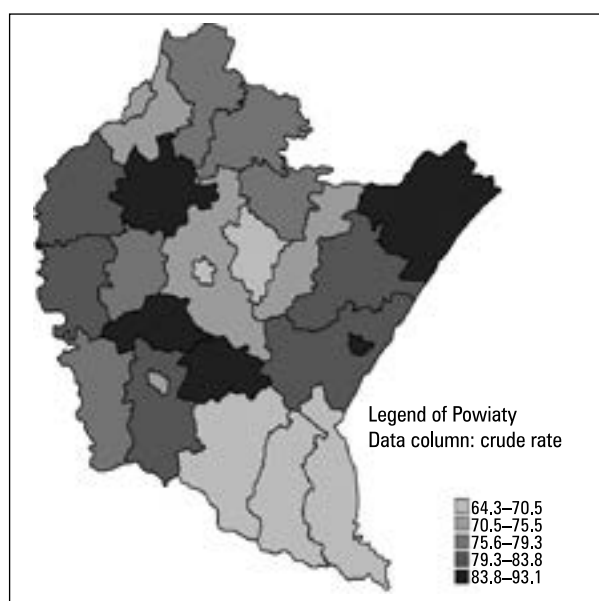


Figure 5. Lung cancer incidence in the Podkarpackie province between 2002–2011 by districts, males

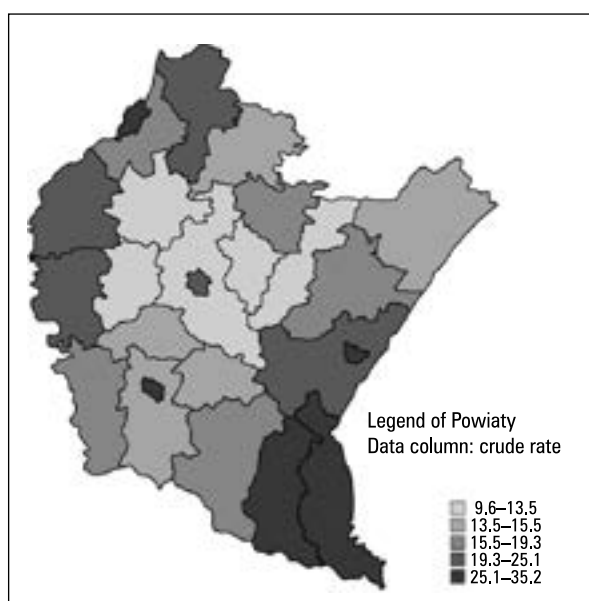


Figure 6. Lung cancer incidence in the Podkarpackie province between 2002–2011 by districts, females

Table 5. Deaths and lung cancer mortality in the Podkarpackie province between 2002–2011

Cancer cases	Deaths males				Year	Deaths females				
	Crude rate per 100 000	Standardized rate	Percentage	Cumulative risk		Cancer cases	Crude rate per 100 000	Standardized rate	Percentage	Cumulative risk %
7211	–	–	–	–	2002-2011	1571	–	–	–	–
734	70.9	56.6	31.8	7.4	2002	130	12.0	7.5	8.6	0.9
734	71.2	55.7	30.9	7.0	2003	152	14.1	8.8	9.0	1.1
760	73.7	57.4	32.1	7.3	2004	139	12.9	7.7	8.7	0.9
738	71.6	54.2	31.1	7.0	2005	154	14.3	8.7	9.1	1.0
707	68.6	50.7	29.0	6.4	2006	148	13.8	7.4	8.5	0.9
760	73.8	53.4	30.4	6.7	2007	162	15.0	8.7	9.4	1.0
739	71.8	49.8	29.5	6.2	2008	185	17.2	9.3	10.6	1.2
738	71.6	48.6	28.8	5.9	2009	175	16.2	8.2	9.7	1.0
689	66.2	45.2	29.6	5.7	2010	168	15.6	8.7	10.5	1.1
612	58.8	38.7	26.7	4.9	2011	158	14.5	8.0	9.7	1.0

Deaths and mortality

The number of deaths due to malignant lung cancer in total amounted to 770 in 2011, and was by 10.9% lower than in 2002. During the discussed period, the decrease in the number of deaths by 16.6% in men was noted and a simultaneous increase in the number of deaths due to lung cancer by 21.5% in women was observed. In the study period, a significant decrease in crude and standardised rates of mortality in men was noted. Crude rate was equal to 70.9/100 000 in 2002, and to 58.8/100 000 in 2011. Whereas standardised rate amounted to 56.6/100 000 in 2002, and to 38.7/100 000 in 2011.

On the other hand, in the female population, mortality rates increased. Crude rate was equal to 12.0/100 000 in 2002, and to 14.5/100 000 in 2011. Standardised mortality rates also increased and they amounted to 7.5/100 000 in 2002, and to 8.0/100 000 in 2011.

The proportion of deaths due to lung cancer among all cancer deaths in men decreased by 5.1%, but in women it increased by 1.1%. Similarly, cumulative risk in men decreased from 7.4 in 2002 to 4.9 in 2011, whereas in women it increased from 0.9 in 2002 to 1.0 in 2011 (Table 5).

The highest mortality due to malignant lung cancer in men in the Podkarpackie province in 2002 and 2011 was noted in the group aged 65+. Mortality rates during this time were 461.1/100 000 in 2002 and 349.4/100 000 in 2011. During the study period, a considerable decrease in mortality was observed for the groups aged 45–64

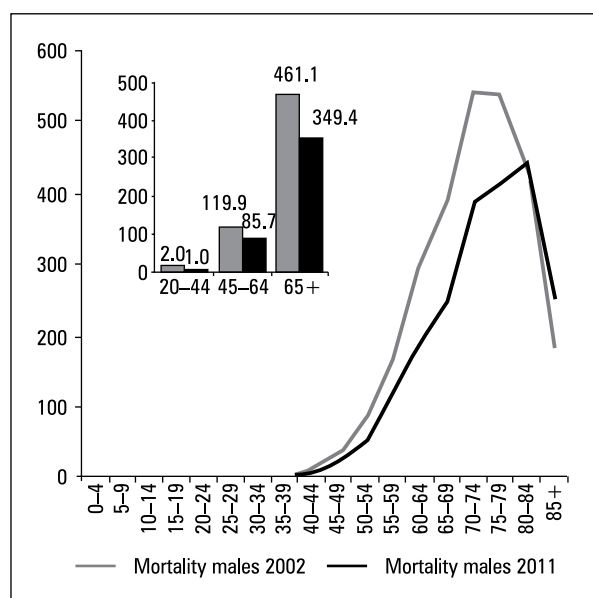


Figure 7. Lung cancer mortality by age groups in the Podkarpackie province between 2002–2011, males

years and 65+. The peak of incidence in 2002 occurred in the 8th decade of life, and in 2011, in the 9th decade of life (Fig. 7).

At the same time, in women, in the group aged 65+, the highest mortality rates were noted. They were equal to 49.0/100 000 in 2002, and to 47.5/100 000 in 2011. While comparing selected age groups in men and women, the decrease in mortality in men in all age groups was observed, whereas in women, a slight decrease occurred

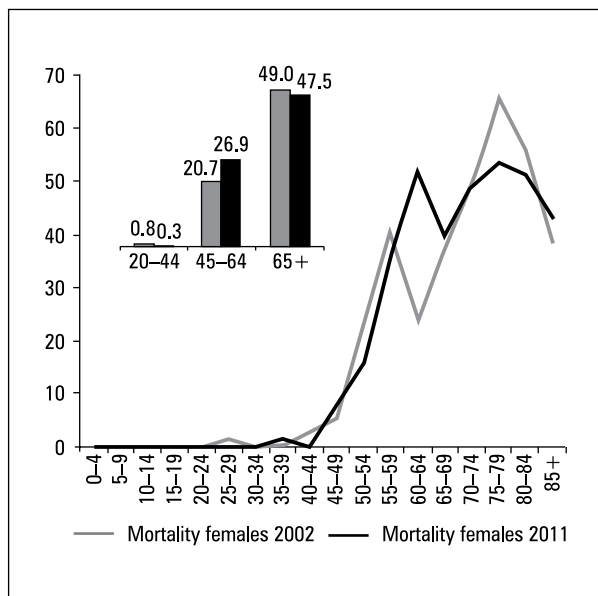


Figure 8. Lung cancer mortality by age groups in the Podkarpackie province between 2002–2011, females

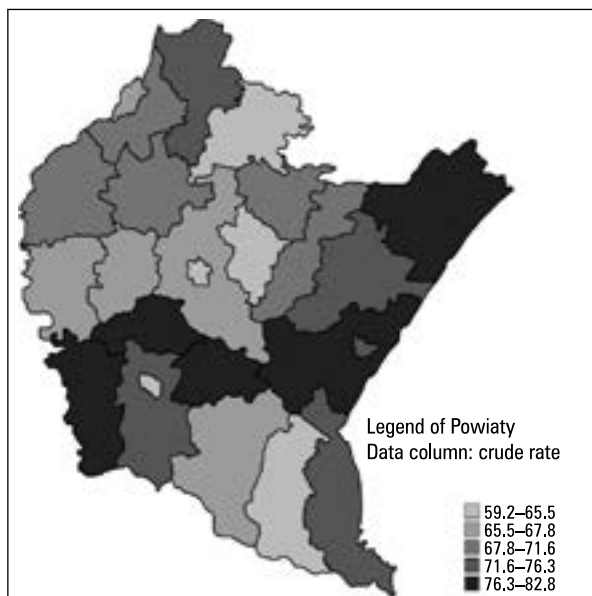


Figure 9. Lung cancer mortality in the Podkarpackie province between 2002–2011 by districts, males

Table 6. Lung cancer mortality in the Podkarpackie province by districts, crude rate per 100 000 persons

District	Mortality males	Mortality females
bieszczadzki	75.9	22.9
brzozowski	76.3	13.1
dębicki	66.6	10.5
jarosławski	71.6	16.3
jasielski	78.6	14.4
kolbuszowski	70.2	6.1
krośnieński	71.7	11.5
leżajski	67.8	13.0
lubaczowski	82.8	12.6
łańcucki	60.3	9.2
mielecki	70.9	16.8
nizański	65.1	10.6
przemyski	77.6	15.4
przeworski	70.7	13.3
ropczycko-sędziszowski	66.3	8.0
rzeszowski	67.6	9.5
sanocki	67.0	15.5
stalowowolski	74.2	15.9
strzyżowski	81.5	16.1
tarnobrzeski	69.5	11.6
leski	61.6	25.3
m. Krosno	59.6	22.1
m. Przemyśl	73.9	29.0
m. Rzeszów	59.2	20.4
m. Tarnobrzeg	65.5	19.3

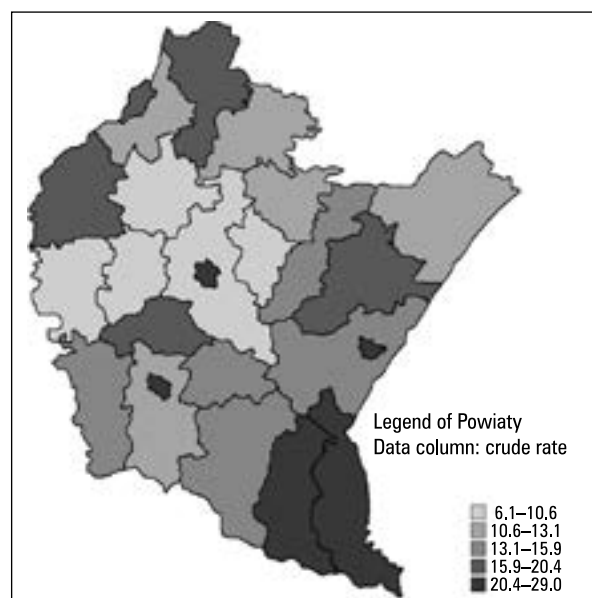


Figure 10. Lung cancer mortality in the Podkarpackie province between 2002–2011 by districts, females

in the groups aged 20–44 and 65+, whereas in the group aged 45–64 a considerable increase in mortality was noted (by 53.1%). In 2002, the increase in mortality occurred in the 6th and 8th decade of life, and in 2011, the height of mortality occurred in the 7th and 8th decade (Fig. 8).

In the Podkarpackie province, a high diversity of mortality due to lung cancer in particular districts is observed. In the years 2002–2011, the highest mortality rates in men were noted in the lubaczowski district — 82.8/100 000, strzyżows-

ki — 81.5/100 000, jasielski — 78.6/100 000 and przemyski — 77.6/100 000. Whereas the lowest mortality was observed in the city of Rzeszów — 59.2/100 000, the town of Krosno — 59.6/100 000, the łańcucki district 6.3/100 000 and leski district — 61.6/100 000. In women, the highest mortality was found in the town of Przemyśl — 29.0/100 000, the leski district — 25.3/100 000, bieszczadzki — 22.9/100 000, and in the town of Krosno — 22.1/100 000. The lowest mortality was noted in the kolbuszowski district — 6.1/100 000, ropczycko-sędziszowski — 8.0/100 000, łańcucki — 9.2/100 000 and rzeszowski — 9.5/100 000 (Table 6, Figs 9, 10).

Discussion

Between the years 1970–1974, in Poland, deaths due to lung cancer constituted approximately 25% of all cancer deaths in men and 5% in women. The lowest incidence rates at that time were observed in the eastern provinces [17]. During the following two decades, a dynamic growth in the mortality rate in both sexes has been noted. Stability and a slow decrease in mortality in men did not occur until the end of the 1990s [6].

While comparing the structure of incidence and deaths in men in Poland and in the Podkarpackie province in 2011, lung cancer was taking the first place. Whereas among women in Poland, it was taking the second place, and in the Podkarpackie province — it was on the fifth position. But taking into account the structure of deaths among women in Poland, lung cancer took the first place, and in the Podkarpackie province — the third one.

In Poland and in the Podkarpackie province, a considerable fall in incidence rates among men has been observed. Between the years 2002–2011, in men, standardised incidence rates were equal to 63.0/100 000 for Poland and 64.4/100 000 for the Podkarpackie province in 2002, and 50.0/100 000 for Poland and 43.6/100 000 for the Podkarpackie province in 2011. In the discussed period, standardised rates in the years 2002, 2006–2009 in the Podkarpackie province reached higher values, compared to those for Poland. Whereas in women, during the study period, a considerable growth in mortality occurred, both in Poland and in the Podkarpackie province. However, during the discussed period, standardised rates for Poland took higher values than the coefficients for the Podkarpackie province.

Mortality due to lung cancer in men, in Poland and the Podkarpackie province between

2002–2011 had a downward tendency, and the rates for the examined province for the analysed period were considerably lower, compared to the rates for Poland. Similar was the situation in women. Mortality rates for the analysed period of time in women living in the Podkarpackie province were considerably lower, compared to the rates for Poland.

In Poland, there is a great diversity of incidence and mortality between men and women. The highest incidence in men in 2011 was noted in the Świętokrzyskie province and the lowest in Podlasie. In as many as 10 provinces of Poland, incidence rates were higher than the mean for the country. In women, the highest incidence occurred in the Łódź province and it was twice as high as in the Podkarpackie province. The latter also had the lowest mortality rate for men and women in Poland. Whereas the highest rates were found in men in the Mazowieckie province, and in women in the Pomorskie province (Table 8).

According to the forecast concerning mortality from malignant lung cancer in Poland, mortality among men aged 35+ and 35–69 will decrease by 2025, while it will increase permanently in the oldest group aged 70+. In women, an upward tendency has been foreseen in all age groups [18]. Despite the decrease in standardised mortality rates, the number of deaths will grow. The decrease in deaths by approximately 12.5% has been foreseen solely in men aged 35–69 years. The highest increase in deaths count has been foreseen for the oldest group aged 70+ (119.4% in men, and 110.2% in women) [18].

Poland is one of the countries with the highest rates (33.43/100 000). The lowest incidence was observed in Germany (22.16/100 000), where standardised rate was twice as high as in Hungary (43.32/100 000). The lowest mortality rates were found in Slovakia, Czech Republic and Germany, whereas a considerably high standardised rate was noted in Hungary (Table 9).

In EURO-CARE-5 (concerning the patients diagnosed between the years 2000–2007), a 5-year relative survival for Poland was 14.25% (Table 9). According to the analysis of patients diagnosed between 2003–2005 prepared by the National Cancer Register, the proportion of 5-year relative survivals in Poland was 11.9% for men and 16.9% for women [20]. The proportion of survival for men in the Podkarpackie province was equal to that for Poland, whereas in women, the rates were higher by 3%, compared to the rate for Poland (patients diagnosed between 2000–2002) [21].

Table 8. Lung cancer incidence and mortality in Poland by provinces, 2011 [4]

Province	Incidence males	Province	Incidence females	Province	Mortality males	Province	Mortality females
Podlaskie	56.59	Podkarpackie	19.52	Podkarpackie	58.76	Podkarpackie	14.55
Lubuskie	63.62	Podlaskie	19.66	Małopolskie	74.19	Małopolskie	22.27
Podkarpackie	64.71	Małopolskie	22.86	Opolskie	75.15	Lubelskie	22.94
Małopolskie	67.22	Lubelskie	23.12	Podlaskie	80.97	Świętokrzyskie	26.26
Zachodniopomorskie	71.57	Świętokrzyskie	26.57	Wielkopolskie	81.27	Podlaskie	27.63
Mazowieckie	73.00	Mazowieckie	29.31	Polska	85.58	Opolskie	28.98
Polska	77.87	Lubuskie	30.30	Lubelskie	86.30	Polska	31.47
Wielkopolskie	78.41	Polska	31.61	Śląskie	86.50	Śląskie	31.70
Opolskie	80.45	Wielkopolskie	31.77	Zachodniopomorskie	88.12	Wielkopolskie	33.13
Lubelskie	80.70	Opolskie	32.22	Kujawsko-Pomorskie	88.70	Lubuskie	35.06
Śląskie	81.13	Śląskie	33.58	Dolnośląskie	88.76	Łódzkie	35.10
Dolnośląskie	83.84	Zachodniopomorskie	36.79	Lubuskie	89.51	Kujawsko-Pomorskie	35.33
Łódzkie	84.40	Kujawsko-Pomorskie	38.01	Pomorskie	89.87	Mazowieckie	35.90
Pomorskie	85.28	Dolnośląskie	38.46	Świętokrzyskie	89.89	Dolnośląskie	36.22
Kujawsko-Pomorskie	89.09	Pomorskie	39.48	Warmińsko-Mazurskie	91.17	Zachodniopomorskie	36.57
Warmińsko-Mazurskie	91.74	Warmińsko-Mazurskie	39.80	Łódzkie	91.67	Warmińsko-Mazurskie	37.37
Świętokrzyskie	93.57	Łódzkie	41.35	Mazowieckie	96.73	Pomorskie	38.54

Table 9. Lung cancer incidence and mortality in the selected European countries, 2012, standardised rates, a 5-year relative survival by cancer [3, 19]

Country	Incidence	Mortality	5-year relative survival EURO CARE-5 (2000–2007)
Spain	22.78	30.30	10.61
France	25.33	34.95	14.28
Belgium	30.51	36.81	14.63
Germany	22.16	27.51	15.61
Poland	33.43	38.03	14.25
Hungary	43.32	51.60	has not participated in the study
Romania	27.60	32.56	has not participated in the study
Serbia	39.06	45.57	has not participated in the study
Great Britain	25.36	29.95	7.41
Slovakia	28.27	21.60	10.33
Czech Republic	32.45	24.70	11.31

In 2006, a population study using a questionnaire was conducted in 16 provinces. Its objective was to evaluate the knowledge and attitude of about 8000 Poles towards healthy

lifestyle rules included in the European Code Against Cancer. 78.4% of respondents believed that they took care of their health. The most vital factor of lung cancer incidence is tobacco smok-

ing. The results of the study has shown that men smoked more frequently than women, apart from the oldest age group (60+), and that the number of smokers is increasing together with age. The highest proportion of smokers occurred in the Lower Silesia province (39.1%) and the Kuyavian-Pomeranian and Opole provinces (36.3%), whereas the smallest was observed in the Podkarpackie province (23%). In the Podkarpackie province, a considerable proportion of the study subjects reported to have been never smokers (61.8%). The conclusions drawn from the study suggest that preventive programs should be addressed to poorer and less educated social groups, on the other hand, the provinces of Poland with the highest incidence rate need more individualised preventive programs [22].

Conclusions

1. In 2011, in the Podkarpackie province, the number of lung cancer incidence in men decreased by 22.4%, compared to 2002, whereas in women, it increased by 22.5%.
2. During the study period, the decrease in mortality due to lung cancer by 16.6% occurred, and a simultaneous increase in mortality in women by 21.45% was observed.
3. In the districts of the Podkarpackie province, between 2002–2011, the highest incidence rate was noted in the lubaczowski district, and the lowest in the kolbuszowski district, while the highest mortality rate was found in the lubaczowski district, and the lowest in the city of Rzeszów.
4. In the districts of the Podkarpackie province, between 2002–2011, the highest incidence rate for women was observed in the town of Przemyśl, and the lowest in the kolbuszowski district, whereas the highest mortality rate was found in the town of Przemyśl, and the lowest in the kolbuszowski district.
5. It is recommended to strengthen appropriate healthy lifestyle patterns and to protect healthy people, particularly women, children and young people from disadvantageous conduct.

Conflict of interest

The authors declare no conflict of interest.

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