

Years of life lost due to colorectal cancer in Poland between 2000 and 2014 according to voivodships

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary Background. Colorectal cancers (CRCs) are among the most important oncological causes of death in Europe. Poland belongs to countries where the mortality rates due to this cause exceed the average values for EU-28.

Objectives. Comparison of the number of years of life lost (YLLs) due to CRC between 2000 and 2014 in Poland by voivodships.

Material and methods. The study was based on a dataset containing information from the death certificates of Poles who died in 2000 and 2014 (368,028 and 376,467 records, respectively). The data on deaths caused by CRC (C18–C21 according to ICD-10) was used for the analysis (8,517 deaths in 2000 and 11,411 deaths in 2014). SEYLL (Standard Expected Years of Life Lost) was implemented to assess YLLs.

Results. In 2000, the highest number of YLLs per 10,000 men was recorded in Zachodniopomorskie (55.7 years), and in 2014 – in Opolskie (77.5 years). The increasing tendency of this measure between 2000 and 2014 in the group of men was observed in all voivodships. In the group of women, in 2000 the highest number of YLLs per 10,000 was reported in Lodzkie (46 years), and in 2014 – in Warmińsko-Mazurskie (49.6 years). In women, an SEYLL_p decline over time was noted only in Lodzkie and Dolnoslaskie, and in other voivodships, its values increased.

Conclusions. Between 2000 and 2014, an upward tendency of YLLs due to CRC was observed in Poland, though with territorial differentiation. It is advisable to search for more effective methods of reducing existing inequalities between individual provinces of Poland.

Key words: colorectal neoplasms, social conditions, life expectancy, vital statistics.

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Background

Malignant neoplasms, along with cardiovascular diseases, are the most important causes of death among Europeans. It is estimated that more than every fourth death in the EU-28 countries is due to oncological causes – in 2014, they caused 26.4% of all deaths, and the dominant share included neoplasms of the lungs (20.1% of all cancer-related deaths), colorectum (11.3%), breast (6.9%) and prostate (5.5%) [1].

To improve the epidemiological situation regarding malignant neoplasms in Europe, in 2003, the Council of the European Union introduced recommendations on screening programs aimed at early detection of malignancies of the colon (fecal occult blood test performed in people aged 50–74 years), the breast (mammography performed in women between the age of 50–69 years) and the uterine cervix (cytological examination in women over 20–30 years of age) [2]. Unfortunately, these have not been widely translated into clinical practice as of yet. The results of the *European Health Interview Survey* (EHIS) from 2014 revealed that more than half of Europeans who qualified for screening for colorectal cancers (CRC) had never had a fecal occult blood test (including 81.7% of Poles), and just over 18% had this performed in the past 12 months before the survey (4.2% in Poland) [3]. In some countries, a colonoscopy is also included in the screening for CRC. In Poland, personal invitations to these examinations have been sent to people aged 55–64 from 2012; however, the percentage of applications does not exceed 20% annually (the highest response rate was noted in 2014 and was 17.4%) [4].

According to Eurostat, the values of the standardized mortality rate due to CRC for the EU-28 has slightly improved recently, but still in many European countries, an adverse trend

of mortality for this reason is observed. In 2011, in the EU-28, the rate was on average 32.05 per 100,000 inhabitants, while in 2015, it was 30.40 per 100,000. At that time, the death rate for Poland was 35.77 and 37.83 per 100,000, respectively. In 2015, the highest values of this measure were recorded in Hungary (54.10 per 100,000), in Croatia (49.95 per 100,000) and in Slovakia (49.48 per 100,000); they were the lowest in Cyprus (19.31 per 100,000), in Finland (21.84 per 100,000) and in Greece (23.23 per 100,000) [1].

In many publications, attention is also drawn to differences in mortality for various reasons, not only between EU countries, but also between regions belonging to one country [5–10].

Currently, synthetic measures, such as DALY (*Disability-adjusted Life Years*) and its components YLL (*Years of Life Lost*) and YLD (*Years of Life with Disability*), are widely in use to assess the health status of a population [11]. YLL, in contrast to traditionally used mortality rates, takes into account not only the number of deaths, but also the age of the individuals at the moment of death. Therefore, it can be used to evaluate the socio-economic aspects of mortality due to different causes [12–14].

Objectives

The aim of this study was to compare YLLs due to CRC between 2000 and 2014 in Poland according to voivodships.

Material and methods

The study was based on a dataset containing information gathered from the death certificates of Poles who died in 2000 ($n = 368,028$) and 2014 ($n = 376,467$), provided by the Central



Statistical Office in Poland. Information on deaths caused by CRC was used for the analysis, i.e. covered by codes C18–C21 according to the *International Classification of Diseases and Related Health Problems, 10th Revision (ICD-10)*.

The SEYLL (*Standard Expected Years of Life Lost*) measure was used to assess YLLs. Its value was calculated in accordance with the method developed by Murray and Lopez [15]:

$$SEYLL = \sum_{\chi=0}^l d_{\chi} e_{\chi}^*$$

where:

e_{χ}^* is the average life expectancy for a particular age determined based on standard population;

d_{χ} is the number of deaths at age χ ;

χ is the age of death;

l is the oldest age in the population.

The expected lifespan for a given age was determined on the basis of the life table published by the *World Health Organization (WHO)* in 2012. According to this source, the life expectancy for both sexes at age 0 is 86.02 years [16].

We also implemented the SEYLL_p measure (*Standard Expected Years of Life Lost per person*), which is a ratio of YLLs to the number of a population, in this study calculated per 10,000 inhabitants; and the SEYLL_d measure (*Standard Expected Years of Life Lost per death*), which is a quotient of YLLs and the number of deaths caused by a particular disease.

The Bioethics Committee of the Medical University of Lodz gave consent for the study to be conducted (No. RNN/183/17KE of June 13, 2017).

Results

In 2000, CRCs were the cause of 8,517 deaths in the Polish population (2.3% of all deaths) – 4,373 deaths of men and 4,144 deaths of women, while in 2014, it was 11,411 deaths (3% of all deaths) – 6,423 deaths in the group of men and 4,988 in the group of women. Data on the number of deaths due to CRC according to voivodships is given in Table 1.

Table 1. Number of deaths from colorectal cancer in Poland in 2000 and 2014 according to voivodships

Voivodship	Men		Women	
	2000	2014	2000	2014
Dolnoslaskie	373	505	366	395
Kujawsko-pomorskie	242	382	235	287
Lubelskie	224	365	197	223
Lubuskie	118	170	91	111
Lodzkie	306	406	349	371
Malopolskie	345	528	321	389
Mazowieckie	598	829	603	691
Opolskie	125	198	117	137
Podkarpackie	201	271	157	209
Podlaskie	112	202	132	161
Pomorskie	248	370	222	305
Slaskie	583	842	515	663
Swietokrzyskie	138	213	124	167
Warminsko-mazurskie	132	209	125	202
Wielkopolskie	403	616	451	468
Zachodniopomorskie	225	317	139	209
Total	4,373	6,423	4,144	4,988

These deaths translated into a total of 162,365.5 YLLs in 2000 (SEYLL_p = 42.4 years) – 88,250.1 YLLs in the group of men

(SEYLL_p = 47.6 years) and 74,115.4 YLLs in the group of women (SEYLL_p = 37.6 years); while in 2014, they caused 202,208.5 YLLs (SEYLL_p = 52.6 years) – 119,700.4 YLLs in men (SEYLL_p = 64.3 years) and 82,508.1 YLLs in women (SEYLL_p = 41.5 years). The value of SEYLL_d in 2000 was on average 19.1 years – a man who died during that time due to CRC lost on average 20.2 years, and a woman lost 17.9 years; while in 2014, it was on average 17.7 years – 18.6 years in the group of men and 16.5 years in the group of women.

In 2000, the highest number of YLLs per 10,000 men was recorded in the voivodship of Zachodniopomorskie (SEYLL_p = 55.7 years), while in 2014, it was the highest in the voivodship of Opolskie (SEYLL_p = 77.5 years). An increase of the values of this measure between 2000 and 2014 was found in all voivodships (on average by 16.7 years), but in the voivodship of Opolskie, it was the highest (by 25.8 years). In 2000, the lowest number of YLLs was noted for inhabitants of the voivodship of Podlaskie (SEYLL_p = 36.3 years), and in 2014, it was for the voivodship of Podkarpackie (SEYLL_p = 48.3 years). The latter was reported to have the lowest increase in SEYLL_p in the analyzed time (by 8.7 years) (Table 2).

Table 2. Years of life lost due to colorectal cancer in men in Poland in 2000 and 2014 according to voivodships

Voivodships	SEYLL _p		SEYLL _d	
	2000	2014	2000	2014
Dolnoslaskie	53.6	68.9	20.1	19.1
Kujawsko-pomorskie	50.0	71.4	20.6	18.9
Lubelskie	41.2	66.4	19.7	18.9
Lubuskie	54.1	67.1	22.5	19.6
Lodzkie	48.5	64.8	19.9	19.0
Malopolskie	44.6	57.0	20.3	17.6
Mazowieckie	45.9	59.2	18.9	18.2
Opolskie	51.7	77.5	21.5	18.9
Podkarpackie	39.6	48.3	20.3	18.6
Podlaskie	36.3	60.5	19.2	17.4
Pomorskie	46.0	59.3	19.6	18.0
Slaskie	53.4	69.4	21.1	18.2
Swietokrzyskie	45.3	63.9	20.9	18.5
Warminsko-mazurskie	38.1	60.1	20.1	20.3
Wielkopolskie	49.4	71.1	19.9	19.5
Zachodniopomorskie	55.7	71.1	20.5	18.7
Total	47.6	64.3	20.2	18.6

SEYLL_p – Standard Expected Years of Life Lost per person (per 10,000); SEYLL_d – Standard Expected Years of Life Lost per death.

In the group of women, in 2000, the highest number of YLLs per 10,000 was noted in the voivodship of Lodzkie (SEYLL_p = 46.0 years), and in 2014, it was in the voivodship of Warminsko-Mazurskie (SEYLL_p = 49.6 years). In the context of the whole of Poland, between 2000 and 2014, the SEYLL_p value increased by 4.0 years, but the highest increase was recorded in female inhabitants of the voivodship of Warminsko-Mazurskie (by 18.0 years). On the contrary, in the voivodships of Lodzkie and Dolnoslaskie, the occurrence of a downward tendency of SEYLL_p was revealed at the level of -2.6 and -2.4 years, respectively. In the analyzed time, the lowest SEYLL_p values were noted in the voivodship of Podkarpackie (in 2000 – SEYLL_p = 25.9 years; in 2014 – SEYLL_p = 31.9 years) (Table 3).

The value of SEYLL_d in the group of men who died in 2000 ranged between 18.9 years in the voivodship of Mazowieckie and 22.5 years in the voivodship of Lubuskie; while in 2014, it ranged between 17.4 years in the voivodship of Podlaskie and 20.3 years in the voivodship of Warminsko-Mazurskie. Only in

the voivodship of Warminsko-Mazurskie was there an upward tendency of SEYLL_d over time (by 0.2 years).

Table 3. Years of life lost due to colorectal cancer in women in Poland in 2000 and 2014 according to voivodships

Voivodship	SEYLL _p		SEYLL _d	
	2000	2014	2000	2014
Dolnoslaskie	45.2	42.8	18.7	16.3
Kujawsko-pomorskie	40.2	43.3	18.3	16.2
Lubelskie	30.6	34.2	17.6	17.0
Lubuskie	33.9	34.5	19.3	16.3
Lodzkie	46.0	43.3	18.1	15.3
Malopolskie	34.7	37.3	18.0	16.6
Mazowieckie	39.3	39.9	17.3	16.1
Opolskie	40.1	43.1	18.8	16.2
Podkarpackie	25.9	31.9	17.7	16.6
Podlaskie	36.2	40.0	16.9	15.2
Pomorskie	33.5	43.0	16.8	16.6
Slaskie	38.0	47.9	18.1	17.1
Swietokrzyskie	34.4	43.9	18.5	17.0
Warminsko-mazurskie	31.7	49.6	18.5	18.1
Wielkopolskie	45.0	45.1	17.2	17.2
Zachodniopomorskie	30.0	39.2	18.8	16.5
Total	37.6	41.5	17.9	16.5

SEYLL_p – Standard Expected Years of Life Lost per person (per 10,000);
SEYLL_d – Standard Expected Years of Life Lost per death.

In the group of women, the SEYLL_d value was the lowest in the voivodship of Pomorskie – 16.8 years, and it was the highest in the voivodship of Lubuskie – 19.3 years. In 2014, it ranged between 15.2 years in the voivodship of Podlaskie and 18.1 years in the voivodship of Warminsko-Mazurskie. Between 2000 and 2014, the value of SEYLL_d among women decreased in every voivodship.

Discussion

The results of the study confirmed the presence of an unfavorable epidemiological situation regarding CRC in Poland. Comparison of YLLs between 2000 and 2014 revealed an upward trend in both sexes, though with significant territorial differences. In 2000, SEYLL_p, both in men and in women, was above the national average in six of the sixteen voivodships, while in 2014, it concerned nine of them.

In comparison to other regions, the situation of women in the voivodship of Warminsko-Mazurskie seems to be particularly disadvantageous. In 2014, SEYLL_p was in this voivodship the highest in Poland, and it amounted to 49.6 years. Additionally, the largest increase of SEYLL_p over time was recorded here – in 2000, it was 18 years lower. In this voivodship, in 2014 in both sexes, the SEYLL_d values were also among the highest, and what is more, it was the only voivodship in which an increase of this measure in the group of men was found over time.

On the contrary, a relatively good situation, compared to others, was reported in the voivodship of Podkarpackie – in 2014 in both sexes, the lowest SEYLL_p values were recorded here, and in the group of women, this was also the case in 2000. Besides this, in the group of men, the SEYLL_p increase over time in this voivodship was the lowest in Poland.

Available data indicates that in 2014, standardized mortality rates due to CRC were the lowest in the voivodship of Podkarpackie (17.3 per 100,000 inhabitants), while the worst situation was recorded in the voivodship of Wielkopolskie (23.9 per

100,000). Only an analysis of deaths rates in the age group 25–64 revealed results consistent with ours, i.e. the highest death rate among men was noted in the voivodship of Opolskie (21.1 per 100,000), and among women in the voivodship of Warminsko-Mazurskie (11.4 per 100,000) [17].

An important supplement to the analysis of prematurely lost years of life is the assessment of changes of SEYLL_d over time. Virtually throughout Poland (except for the voivodship of Warminsko-Mazurskie in the group of men), a downward trend was recorded. This demonstrates the slow shifting of deaths from CRC to older age groups. This is mainly due to the increasing lifespan and aging of the Polish populations, and to a much lesser extent to the improvement of CRC treatment [18, 19].

A study conducted on the population of the voivodship of Lodzkie revealed that in 1990–2008 among men, CRCs were the second most important cause of YLLs in the group of oncological diseases, after malignant neoplasms of the trachea, bronchi and lungs, and in the group of women, CRCs were second after malignant neoplasms of the trachea, bronchi and lungs and malignant neoplasms of the breast [20]; while a study on the whole Polish population showed that in 2011, out of all disease entities, CRCs were the twelfth most important cause of YLLs among men (1.5% of all YLLs), and tenth in the group of women (2.2% of all YLLs) [21].

According to the *Global Burden of Disease* (GBD), in 2015, CRC caused a loss of approximately 54.2 years of life per 10,000 inhabitants of EU-28, while in Poland, it was 66.2 years per 10,000. The highest number of YLLs due to this cause were noted in Hungary – 97.8 years per 10,000, in Croatia – 85.9 years per 10,000, and in Slovakia – 73.4 years per 10,000 [22].

The recognized risk factors for CRC include: a diet rich in red meat and highly processed food, heat treatment of meat by its frying or grilling, obesity, excessive consumption of alcohol, cigarette smoking, sedentary lifestyle [23–25]. However, the causes of this unfavorable phenomena in the field of prematurely lost years of life due to CRC can be seen in the deterioration of the health attitudes of Poles and the gradual acceptance of a so-called “western lifestyle” [26–28].

In the WOBASZ study (Multi-Center National Population Health Survey), which was conducted in 2003–2005 in Poland, the existence of regional variations in an obedience of health habits was revealed. Analysis of the level of physical activity showed that the highest number of men performing physical activity within the recommended range resided the voivodships of Lubelskie (51%) and Opolskie (47%), while the lowest were in the voivodships of Podlaskie (26%) and Slaskie (32%). Similarly, the female residents of the voivodships of Lubelskie (50%) and Opolskie (46%) were most active, but in the voivodships of Pomorskie (25%) and Slaskie (25%), they were the least [29]. In terms of tobacco smoking status, the highest number of men currently smoking was noted in the voivodship of Podlaskie (48%), and smoking women were dominant in the voivodship of Warminsko-Mazurskie (34%) [30]. The highest number of obese men were recorded in the voivodship of Wielkopolskie (28.2%), and the lowest in the voivodship of Malopolskie (14.25); while the highest share of obese women was noted in the voivodship of Opolskie (24.0%), and the lowest in the voivodship of Podkarpackie (16.1%) [31]. The highest consumption of meat (in grams per day) was recorded in the voivodships of Podlaskie and Warminsko-Mazurskie, while the lowest was in the voivodship of Podkarpackie [32]. Therefore, it seems that this last factor may play a leading role in diversifying the number of YLLs due to CRC in individual provinces.

Comparison of the WOBASZ survey results from 2003–2005 with its subsequent edition from 2013–2014 also revealed the occurrence of disturbing changes in time in the Polish population, such as the decrease in practicing regular physical activity from 37.4% to 27.3% in the group of men and from 32.7% to 28.3% in the group of women [27], or an increase in the percentage of people with abnormal body mass – from 61.6% to

69% in the group of men, and from 50.3% to 59% in the group of women [31].

Undeniably, excessive alcohol consumption is also an important cause of premature loss of life in Poland. According to the GBD, among all disease risk factors, alcohol is the sixth most significant cause of DALY in the Polish population, after elevated blood pressure, cigarette smoking, abnormal body weight, elevated total cholesterol and impaired fasting glucose [33]. As indicate WHO data, the amount of alcoholic beverages consumed by Poles is still increasing – between 2000 and 2014, the consumption of pure alcohol increased from 8.40 to 10.71 liters per capita [34]. This is reflected in the predominant contribution of alcoholic liver disease and fibrosis and cirrhosis of the liver in YLLs in the group of chronic diseases of the digestive system with a non-cancerous etiology in Poland [35, 36]. In addition, data from 2011 indicated that liver cirrhosis was the third, after car accidents and suicides, cause of YLLs per death (SEYLL_y) [21].

Limiting the consumption of alcohol by Poles could affect the reduction of YLLs, not only due to liver diseases associated with excessive alcohol use, but also due to CRC.

Conclusions

Over the years 2000 to 2014, an increase in the number of YLLs due to CRC in Poland was observed, and this phenomenon was characterized by territorial diversity. One of the reasons may be the deteriorating health habits of Poles. It is not possible to determine which risk factors affected the inequalities between voivodships to the greatest extent, but it seems that one of them may be the quantity and type of meat consumed.

It is advisable to continue research on territorial distribution of possible risk factors for CRC and to search for more effective methods of reducing existing inequalities between individual provinces of Poland.

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