

# Years of Life Lost due to Diseases of the Digestive System in Poland in 2000-2014

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## ABSTRACT

**Background & Aims:** Diseases of the digestive system substantially contribute to premature mortality of the Polish population. Years of Life Lost (YLLs) are more and more commonly used in order to evaluate social and economic aspects of these deaths. The aim of the study was to analyse YLLs due to diseases of the digestive system in Poland between 2000-2014.

**Methods:** The study material included a database which contained information gathered from 5,601,568 death certificates of Poles who died between 2000-2014. Data on deaths due to diseases of the digestive system were used for the analysis (i.e. coded as K00-K93 according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision). Standard Expected Years of Life Lost (SEYLL) was used to calculate YLLs.

**Results:** In 2000-2014 diseases of the digestive system contributed to 239,176 deaths of Poles (4.3% of all deaths), which corresponded to 5,470,096.8 YLLs (95.2 years per 10,000 population). Each death due to the above cause was responsible for the average loss of 22.9 years. Diseases of the liver, including alcoholic liver disease and fibrosis and cirrhosis of the liver, contributed to the highest number of YLLs (54.1%).

**Conclusions:** Of all digestive diseases, the dominant causes of YLLs are alcohol-related liver diseases. In order to minimize this phenomenon, it is important to intensify public health activities, aimed at combating alcohol addiction in Poland.

**Key words:** premature mortality – years of life lost – SEYLL – alcohol-related diseases.

**Abbreviations:** AAPC: average annual percentage changes; APC: annual percentage changes; DALY: Disability-adjusted Life Years; EU: European Union; GBD: Global Burden of Disease; ICD-10: International Statistical Classification of Diseases and Related Health Problems, 10th Revision; SDR: standardised death rate; SEYLL: Standard Expected Years of Life Lost; YYL: Years of Life Lost; YLD: Years of Life with Disability; WHO: World Health Organisation.

## INTRODUCTION

The main causes of mortality in the Polish population include cardiovascular diseases, malignant neoplasms and external causes of death [1]. These conditions are given particular attention in the professional medical literature [2-4]. Current data indicate that the epidemiological situation in Poland with regards to diseases of the digestive system is also exceptionally negative [5, 6]. Analyses of the World Health

Organisation (WHO) indicate that standardized death rates due to the above causes are systematically decreasing in Poland; however, they are still higher than mean values noted in European Union (EU) countries. In 2014, the death rate due to diseases of the digestive system in Poland was 30.88 per 100,000 population, whereas the mean value for EU was 26.44 per 100,000 population. The rate of premature mortality due to this reason is particularly alarming – in 2014, its value in the age group 0-64 years was 18.17 per 100,000 Poles, whereas the mean value for the UE was 12.65 per 100,000 population (standardization of rates according to the European population from 1976) [7].

More and more frequently, potential measures, i.e. those which consider living potential of individuals in a population, are applied in epidemiological analyses of premature mortality. They consider not only the number of deaths but also the age

of a person when the death occurred. A computed number of Years of Life Lost (YLLs) constitutes the basis for the evaluation of social and economic aspects of premature deaths [8-10].

In 2011, diseases of the digestive system were the fifth most important cause of YLLs in the Polish population (5.1 years per 10,000 men and 2.3 years per 10,000 women), and cirrhosis of the liver was the third main cause of YLLs calculated per one death (12.1 years per one male death and 11.3 years per one female death), after road traffic accidents (20.2 years and 17.1 years, respectively) and suicides (17.4 years and 15.4 years, respectively) [11].

The aim of the study was the analysis of YLLs due to diseases of the digestive system in Poland in 2000-2014.

## METHODS

The study material included a database which contained information gathered from 5,601,568 death certificates of inhabitants of Poland who died in the period 2000-2014 (starting with the age of 0). The data were provided by the Central Statistical Office in Poland [Suppl. Table 1]. Information on deaths caused by diseases of the digestive system, i.e. bearing codes K00-K93 according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), was subject to analysis.

Mortality rates were calculated with the use of data on the size of population obtained from the Local Data Bank of the Central Statistical Office in Poland [1]. Age standardization of rates was performed with a direct method, where the European population updated in 2013 was considered referential [12].

In order to analyze YLLs, the authors used the *Standard Expected Years of Life Lost* (SEYLL) measure. Its value was calculated according to the original method of Murray and Lopez [9]:

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

where:  $e_{\chi}^*$  stands for a number of expected years of life for a particular age, calculated on the base of referential population;  $d_{\chi}$  stands for a number of deaths at age  $\chi$ ;  $\chi$  stands for the age at which the person died;  $l$  is the oldest age in the population.

The authors also used the *Standard Expected Years of Life Lost per person* (SEYLL<sub>p</sub>) measure, considering the size of the studied population ( $N$ ), in this study calculated per 10,000 inhabitants:

$$SEYLL_p = \frac{\sum_{\chi=0}^l d_{\chi} e_{\chi}^*}{N}$$

The *Standard Expected Years of Life Lost per death* (SEYLL<sub>d</sub>) measure, which shows the number of years of life lost per one dead person, was calculated by dividing SEYLL due to a particular cause by the number of deaths:

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

In order to compute the above calculations, we implemented a life table prepared by the WHO in 2012. It takes into

consideration the mortality rates which are the lowest for each age group in countries with a population higher than 5 million. According to this source, life expectancy of the world's population for both sexes at age 0 is 86.02 years [13].

The time trend analysis was conducted with the application of joinpoint model using the Joinpoint Regression Program. This method is a variant of linear regression analysis in which time trends are expressed in the sequence of segments connected by joinpoints; in these points the changes in values of analyzed parameters are statistically significant ( $p < 0.05$ ). The Permutation test was used to determine the number of joinpoints [14].

Annual percentage changes (APC) in particular time intervals and average annual percentage changes (AAPC) in the whole study period, with their corresponding 95% confidential intervals (95% CI) were calculated for standardized death rate (SDR) and SEYLL<sub>p</sub> [15].

A brief description of Polish demography is noteworthy in order to better understand the results of the study. Poland is a country with an ageing society characterized by the phenomenon of excess mortality of men compared to women. In 2014, Poland had 38,478,602 inhabitants (18,619,809 men and 19,858,793 women), and among them 15.3% people were aged 65 years and more (2,273,421 men and 3,600,626 women). Therefore, the female rate in this age group was 1.58, while for the whole population it was 1.07 [16]. At that time the average life expectancy of a man in Poland was 73.8 years, and of a woman 81.6 years; yet in 2000 it was 69.7 and 78.0 years, respectively [17].

## RESULTS

In 2000-2014, diseases of the digestive system were the cause of 239,176 deaths in the Polish population (4.3% of all deaths of Poles in the analysed period). Of this number, 136,837 deaths (57.2%) occurred in the group of men, and 102,339 deaths (42.8%) occurred in the group of women. SDRs due to diseases of the digestive system for the whole population decreased throughout the study period from 5.59 per 10,000 inhabitants in 2000 to 4.67 per 10,000 in 2014. A time trend analysis revealed that the rates were growing by 2.0% each year in 2000-2005 ( $p < 0.05$ , 95% CI: 0.3; 3.8), but later, they started to decrease by 2.6% per year and dropped until the end of the analysed period ( $p < 0.05$ , 95% CI: -3.2; -1.9). AAPC of the SDRs in the whole study period were negative for both sexes. A decrease in the value of the SDR from 7.40 per 10,000 in 2000 to 6.16 per 10,000 in 2014 in males corresponded to an annual decrease of 0.8% ( $p < 0.05$ , 95% CI: -1.7; -0.0). With regard to females, a downward trend in the rate from 4.17 per 10,000 to 3.43 per 10,000 corresponded to an annual decrease of 1.1% ( $p < 0.05$ , 95% CI: -1.8; -0.5) (Fig. 1, Table I).

Among the diseases of the digestive system, the greatest number of deaths of Poles in 2000-2014 was caused by diseases of the liver – K70-K77 (99,139 deaths – 41.5%), intestinal diseases K55-K63 (37,252 deaths – 15.6%) and diseases of the gallbladder, bile ducts and pancreas – K80-K87 (34,983 deaths – 14.6%). In males, deaths were mostly caused by diseases of the liver (69,461 deaths – 50.8%), gallbladder, bile ducts and pancreas (18,791 – 13.7%) as well as oesophagus,

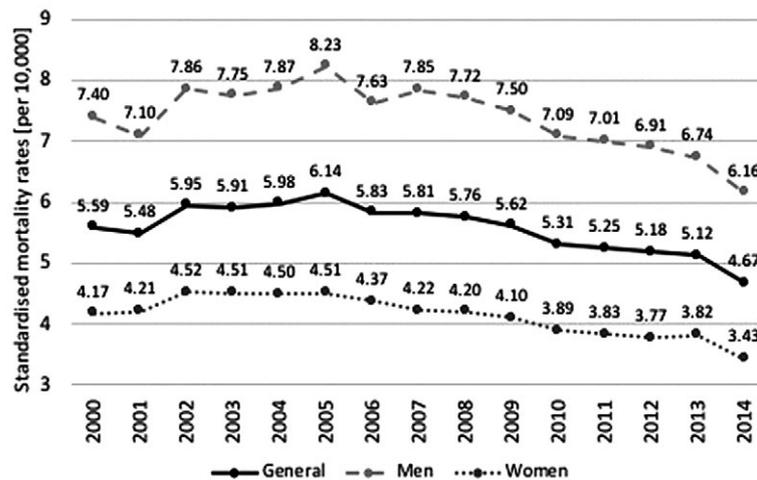


Fig. 1. Standardized death rates due to diseases of the digestive system in Poland in 2000-2014

Table I. Time trends for standardized mortality rates due to diseases of the digestive system in Poland in 2000-2014 by gender per 10,000 population

Gender	APC [%]		AAPC [%]
	2000-2005	2005-2014	
all	2.0* (0.3; 3.8)	-2.6* (-3.2; -1.9)	-1.0* (-1.6; -0.3)
males	2.4* (0.3; 4.6)	-2.6* (-3.5; -1.8)	-0.8* (-1.7; -0.0)
females	2.4* (0.2; 4.7)	-2.5* (-3.0; -2.0)	-1.1* (-1.8; -0.5)

\* changes statistically significant (p<0.05); AAPC – average annual percentage changes; APC – annual percentage changes.

stomach and duodenum – K20-K31 (15,952 deaths – 11.7%). Also in females, diseases of the liver contributed to the highest number of deaths (29,678 deaths – 29.0%), next were diseases

of intestines (22,781 deaths – 22.3%) and third, diseases of the gallbladder, bile ducts and pancreas (16,192 deaths – 15.8%).

In 2000-2014, diseases of the digestive system contributed to a premature loss of 5,470,096.8 years of life (SEYLL) in the Polish population. In males, they contributed to a loss of 3,651,633.8 years (66.8%), whereas in females 1,818,463.0 years (33.2%). As calculated per 10,000 people, it was on average 95.2 years (SEYLLp) – 131.4 years in males and 61.7 years in females. Each death due to this cause corresponded to a mean loss of 22.9 years of life (SEYLLd) – 26.7 years in males and 17.8 years in females (Table II).

Between 2000 and 2008, SEYLLp values increased by 2.7% per year (p<0.05, 95% CI: 1.4; 4.1), and decreased in each year on average by 2.5% (p<0.05, 95% CI: -4.4; -0.5). Similar SEYLLp

Table II. Years of life lost due to diseases of the digestive system in Poland in 2000-2014 by gender

year	males			females		
	SEYLL	SEYLLp	SEYLLd	SEYLL	SEYLLp	SEYLLd
2000	231,819.4	125.1	27.3	112,983.2	57.3	18.3
2001	218,661.2	118.0	26.7	114,955.6	58.3	18.0
2002	221,661.2	119.8	26.6	111,100.5	56.4	17.3
2003	219,861.4	118.9	26.2	112,738.0	57.2	17.2
2004	238,699.0	129.2	26.7	118,141.6	60.0	17.5
2005	256,297.7	138.9	26.8	122,753.7	62.3	17.6
2006	252,860.0	137.2	27.2	126,748.1	64.3	18.2
2007	265,978.2	144.5	27.2	131,318.4	66.6	18.8
2008	275,059.3	149.4	27.7	134,369.0	68.1	18.8
2009	260,150.4	141.2	26.9	129,200.1	65.5	18.2
2010	247,665.9	132.8	26.6	121,874.3	61.3	17.6
2011	249,811.5	133.9	26.5	123,943.8	62.3	17.7
2012	249,920.0	134.0	26.3	125,427.3	63.1	17.8
2013	239,381.1	128.5	25.8	127,209.4	64.0	17.5
2014	223,807.5	120.2	25.6	115,700.0	58.3	17.3
total	3,651,633.8	131.4	26.7	1,818,463.0	61.7	17.8

SEYLL – Standard Expected Years of Life Lost; SEYLLp – Standard Expected Years of Life Lost per person (per 10,000); SEYLLd – Standard Expected Years of Life Lost per death

trends were observed for particular sexes. In the initial period, the value for males increased by 2.8% per year ( $p < 0.05$ , 95% CI: 1.5; 4.2), but in 2008, it started to decline and decreased by 3.0% annually until the end of the study period ( $p < 0.05$ , 95% CI: -5.0; -0.9); with regards to females, the value increased by 2.3% ( $p < 0.05$ , 95% CI: 1.2; 3.4) and then decreased by 1.7% per annum ( $p < 0.05$ , 95% CI: -3.4; -0.0), respectively (Table IIIA).

Diseases of the liver contributed to the highest number of YLLs. SEYLL due to this cause was 2,960,998.9 years, which corresponded to 54.1% of all YLLs caused by diseases of the digestive system. In the group of men, it was 2,156,209.1 years (72.8%), whereas in the group of women it was 804,789.8 years (27.2%). Calculated per 10,000 population, it was 77.6 years in males and 27.1 years in females. Each death due to this cause contributed to a loss of 31.0 years in males and 27.1 years in females (Table IV).

Of all liver diseases, fibrosis and cirrhosis of the liver – K74, and alcoholic liver disease – K70, contributed to the greatest number of YLLs – 1,555,827.2 years (52.5%) and 1,154,722.1 years (39.0%), respectively. Table V presents changes in SEYLLp and SEYLLd values due to selected diseases of the digestive system. Attention is paid to the rapid increase in SEYLLp with a parallel decrease in SEYLLd over time due to alcoholic liver disease. This indicates that the number of deaths due to this cause is growing, but they have shifted to the older age groups.

Average annual percentage changes values of SEYLLp due to fibrosis and cirrhosis of the liver were negative in both sexes. In males, a decline in SEYLLp values from 48.5 years in 2000 to 16.7 years in 2014 corresponded to a decrease of AAPC by 6.3% yearly ( $p < 0.05$ , 95% CI: -7.9; -4.7), whereas in females, a decline in the above value from 17.7 years to 9.2 years corresponded to an annual decrease by 3.3% ( $p < 0.05$ , 95% CI: -5.6; -0.9) (Table IIIB). Alcoholic liver disease contributed to increased SEYLLp values in both sexes. In males, it rose from 17.1 years in 2000 to 48.4 years in 2014, which corresponded to an annual increase of 8.9% ( $p < 0.05$ , 95% CI: 6.0; 11.7); and in females, from 3.1 years to 15.1 years,

respectively, corresponding to an annual increase by 13.8% ( $p < 0.05$ ; 95% CI: 9.5; 18.3) (Table IIIC).

**Table III.** Time trends of SEYLLp for diseases of the digestive system in Poland in 2000-2014 by gender: A – in total (K00-K93 according to the ICD-10), B – fibrosis and cirrhosis of the liver (K74), C – alcoholic liver disease (K70), D – acute pancreatitis (K85)

A.			
gender	APC [%]		AAPC [%]
	2000-2008	2008-2014	
all	2.7* (1.4; 4.1)	-2.5* (-4.4; -0.5)	0.5 (-0.5; 1.5)
males	2.8* (1.5; 4.2)	-3.0* (-5.0; -0.9)	0.3 (-0.7; 1.3)
females	2.3* (1.2; 3.4)	-1.7* (-3.4; -0.0)	0.5 (-0.3; 1.4)
B.			
gender	APC [%]		AAPC [%]
	2000-2009	2009-2014	
all	0.0 (-1.8; 1.8)	-14.3* (18.0; -10.5)	-5.4* (-7.0; -3.7)
males	0.4 (-2.2; 1.3)	-16.0* (19.6; -12.3)	-6.3* (-7.9; -4.7)
females	1.2 (-1.3; 3.9)	-11.0* (-16.4; -5.3)	-3.3* (-5.6; -0.9)
C.			
gender	APC [%]		AAPC [%]
	2000-2008	2008-2014	
all	14.4* (10.3; 18.6)	3.9 (-1.8; 0.0)	9.8* (6.7; 12.9)
males	13.1* (9.4; 17.0)	3.3 (-1.9; 8.9)	8.9* (6.0; 11.7)
females	20.1* (14.3; 26.3)	5.8 (-2.1; 14.4)	13.8* (9.5; 18.3)
D.			
gender	APC [%]		AAPC [%]
	2000-2009	2009-2014	
all	0.4 (-1.1; 1.8)	-6.6* (-9.8; -3.3)	-2.2* (-3.5; -0.8)
males	1.3 (-0.4; 3.0)	-7.1* (-10.8; -3.3)	-1.8* (-3.3; -0.3)
females			-2.9* (-3.7; -2.1)

\* changes statistically significant ( $p < 0.05$ ); SEYLLp – Standard Expected Years of Life Lost per person (per 10,000); AAPC – average annual percentage changes; APC – annual percentage changes.

**Table IV.** Years of life lost due to diseases of the digestive system in Poland in 2000-2014 by gender and cause

cause	ICD-10	males		females	
		SEYLLp	SEYLLd	SEYLLp	SEYLLd
diseases of the oral cavity, salivary glands and jaws	K00-K14	0.0	32.2	0.0	14.8
diseases of the oesophagus, stomach and duodenum	K20-K31	13.0	22.6	6.4	14.4
diseases of the appendix	K35-K38	0.3	20.3	0.2	16.2
hernia	K40-K46	1.0	14.5	1.4	12.0
non-infective enteritis and colitis	K50-K52	1.1	23.1	1.2	17.7
other diseases of intestines	K55-K63	9.3	17.9	9.8	12.8
disorders of the peritoneum	K65-K67	3.0	19.9	2.8	15.1
diseases of the liver	K70-K77	77.6	31.0	27.1	27.1
diseases of the gallbladder, bile ducts and pancreas	K80-K87	18.6	27.5	8.7	15.9
other diseases of the digestive system	K90-K93	7.5	20.3	4.1	13.1
total		131.4	26.7	61.7	17.8

ICD-10 – International Classification of Diseases and Related Health Problems, 10th Revision; SEYLLp – Standard Expected Years of Life Lost per person (per 10,000); SEYLLd – Standard Expected Years of Life Lost per death.

**Table V.** Years of life lost due to selected diseases of the digestive system in Poland in 2000-2014 by cause

year	alcoholic liver disease (K70)		fibrosis and cirrhosis of the liver (K74)		acute pancreatitis (K85)	
	SEYLLp	SEYLLd	SEYLLp	SEYLLd	SEYLLp	SEYLLd
2000	9.9	36.3	32.6	28.5	10.7	27.0
2001	9.1	35.3	30.6	28.1	10.4	25.8
2002	10.0	35.4	29.2	28.2	10.0	25.5
2003	10.7	34.4	28.3	28.3	10.0	25.0
2004	13.7	34.9	30.6	28.6	10.2	24.9
2005	15.1	34.3	32.3	28.6	10.7	25.0
2006	17.8	34.4	32.3	28.9	10.1	25.8
2007	25.3	34.9	30.5	28.5	10.3	24.7
2008	26.6	33.8	31.3	28.7	11.3	25.7
2009	24.2	33.2	28.7	28.1	10.6	24.8
2010	23.0	33.4	25.5	27.9	9.8	24.8
2011	25.4	33.0	23.5	27.3	9.6	25.0
2012	30.0	33.1	20.4	26.4	7.8	23.4
2013	29.2	32.8	17.9	25.4	8.4	24.0
2014	31.2	31.9	12.8	24.6	7.6	23.0
mean	20.1	33.7	27.1	28.0	9.8	25.0

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

Of all diseases of the digestive system, diseases of the gallbladder, bile ducts and pancreas constituted the second most important cause of YLLs, after liver diseases. They contributed to 773,928.4 YLLs (14.2%) – in males it was 516,715.6 years (66.8%), and in females 257,212.8 years (33.2%). This translated into 18.6 years per 10,000 males and 8.7 years per 10,000 females. The SEYLLd value due to this cause was 27.5 years in males and 15.9 years in females. Acute pancreatitis – K85 contributed to the greatest number of YLLs in this group of diseases, i.e. 565,166.2 years (73.0%). Average annual percentage changes of SEYLLp values due to this cause tended to decrease in both sexes; in males, the value was -1.8% ( $p < 0.05$ ; -3.3; -0.3), where SEYLLp decreased from 15.0 years in 2000 to 11.1 years in 2014, and in females, it was -2.9% ( $p < 0.05$ ; -3.7; -2.1) where SEYLLp decreased from 6.8 years to 4.2 years, respectively (Table IIID).

Besides, the greatest number of YLLs in the class of diseases of the digestive system was caused by diseases of intestines – 549,961.1 years (10.1%), and diseases of the oesophagus, stomach and duodenum, which contributed to a loss of 549,745.8 years (10.1%).

## DISCUSSION

Diseases of the digestive system are the cause of every 25th death of Poles each year, after cardiovascular diseases, malignant neoplasms, external causes of death and diseases of the respiratory tract [1].

According to Eurostat, in 2014 in the Polish population, SDR due to diseases of the digestive system was 46.9 per 100,000 people (compared to 46.7 per 100,000 stated in our study), which placed Poland the tenth of all 28 EU countries in

this respect. With regards to EU countries, the highest values were observed in Slovakia (67.38 per 100,000), whereas the lowest were in Greece (27.90 per 100,000) [18].

Among the diseases of the digestive system, in the years 2000-2014, the principal cause in mortality in the Polish population was diseases of the liver comprising alcoholic liver disease as well as fibrosis and cirrhosis of the liver. In each analyzed year, liver diseases contributed to about 40% of the total number of deaths which occurred in the group of digestive diseases. However, in some European countries, the situation is even worse, i.e. more than every second death which occurs in this group is caused by chronic diseases of the liver. In 2014, the proportional mortality rate due to diseases of the liver was 50.5% in Slovenia and Hungary, and in Romania it was as high as 62.2%. SDRs due to diseases of the liver were also the highest in the mentioned countries – 47.79 per 100,000 population in Romania and 32.36 per 100,000 in Hungary. Poland was the 13<sup>th</sup> of all EU countries, with the rate of 15.80 per 100,000. The value for Poland exceeded the mean value for the 28 member states, which was 14.30 per 100,000. Among the countries with the SDRs below the European average were Netherlands (4.90 per 100,000), Greece (6.64 per 100,000), Italy (8.81 per 10,000) and France (10.88 per 10,000) [19].

Alcohol consumption undoubtedly affects the geographical distribution of the mortality rate due to the above causes. It was confirmed that it was not only the amount of consumed alcohol (including unregistered home-made alcoholic beverages) but also the type of alcohol and the drinking pattern that mattered [20, 21]. The WHO data indicates that over the period 2000-2014, consumption of pure alcohol in Poland increased from 8.40 to 10.71 litres per person, and since 2008, its value has been continually higher than the mean value for EU countries.

This observation appears to be alarming when we consider the fact that the average alcohol consumption in EU countries tended to decrease at that time – it declined from 11.14 litres per person in 2000 to 10.17 litres in 2014. Another worrying aspect concerns the type of alcohol consumed by Poles; a high consumption of spirits and beer continues to rise, whereas consumption of wine is decreasing [7].

It is difficult to compare the epidemiological situation between particular countries with regards to the YLLs caused by diseases of the digestive system (as well as other diseases), due to the different methodology used for calculation purposes. The authors of this study used the SEYLL index in order to determine premature mortality, and a life table published by the WHO was used to make calculations [13]. However, other measures are also in use in medical literature, including Potential Years of Life Lost (PYLL) or Period Expected Years of Life Lost (PEYLL). Besides, other referential values can be used to calculate SEYLL, e.g. the Coale-Demeny's life tables prepared on the basis of the Japanese population [5, 11, 22].

The Global Burden of Disease (GBD) study systematically undertakes estimates of YLLs for various populations and according to different causes. The analyses show that in the year 2014, Poland was the 11th of all EU countries with regards to YLLs caused by cirrhosis and other chronic liver diseases due to alcohol use. With regards to mortality rates due to this disease, Poland was the 17th [23]. This divergence indicates that the phenomenon of premature mortality due to diseases of the liver, particularly those related to alcohol consumption, is an important problem in the Polish population. This assumption was confirmed by our study, which revealed that throughout the whole analyzed period in the group of diseases of the digestive system, the percentage of YLLs due to diseases of the liver was higher than the percentage of deaths.

Furthermore, analyses of the GBD Study indicate that, in 2014, the value of the Disability-Adjusted Life Years (DALY) measure due to cirrhosis and other chronic liver diseases caused by alcohol abuse, which comprises YLLs and Years of Life with Disability (YLDs), placed Poland the 13th of all EU countries. The highest values of DALY due to the above diseases were observed in Romania and Hungary, while the lowest values were noted in Italy and Netherlands [23]. The analyses also included the relationship between selected risk factors for chronic diseases and the DALY value in particular populations. With regards to this, alcohol consumption was the sixth most important risk factor in the Polish population in 2015. A similar observation was made for whole Central Europe, but in Eastern Europe this risk factor occupied the third position. Globally, it is on the ninth position [24].

Alcohol-related premature mortality is therefore a major problem in European countries [25]. Rehm et al. [21] confirmed that in 2002, in eight European countries almost 15% of deaths (17.3% in males and 8.0% in females) aged 20-64 years, were caused by excessive alcohol consumption. Another study, conducted in the years 2006-2012 in Mexico City, revealed that alcohol-related mortality rates were 3.9% in males and 0.4% in females [26]. In Canada, 7.7% of deaths in people aged 0-64 years, which occurred in 2005, were caused by alcohol abuse [27]. A study conducted in San Francisco in 2004-2007 revealed that about 10% of YLLs in males and

about 5% in females were related to excessive alcohol use [28]. All the mentioned studies noted that male mortality was distinctively higher than that of females due to this cause, which corresponded to the results obtained by us.

Combating alcohol abuse is still one of the most crucial tasks for organisations and bodies dealing with public health problems in Poland. It is estimated that each year expenditure of the Polish budget due to alcohol-related problems constitutes 1.3% of the Gross Domestic Product [29]. Minimizing this negative trend is one of the objectives of the National Health Programme for the years 2016-2020 [30]. Similar initiatives are implemented at the European level as well as all around the world. Since 2010, 193 WHO member states, in their attempts to reduce alcohol abuse, have been following the Global Strategy to Reduce Harmful Use of Alcohol [31]. The attempts to identify people abusing alcohol and to implement appropriate health education, as part of preventive programs conducted in local communities seem to be recommended. A positive example of such activities is the cardiovascular preventive program run in Poland [32]. Efforts aimed at reducing cardiovascular risk of Polish residents could also have an impact on improving health in the field of digestive system diseases. This may be reflected by the gradual decline in the values of SEYLLp due to this cause observed since 2008, after a previous upward trend.

These positive changes in the whole group of diseases of the digestive system were related to the decrease in SEYLLp values due to fibrosis and cirrhosis of the liver and acute pancreatitis. However, SEYLLp due to alcoholic liver disease showed an upward trend throughout the study period. An improvement in the SEYLLd values due to alcoholic liver disease, which indicates the shift of these deaths to older age groups, gives the hope for a forthcoming gradual reduction of the phenomenon of premature mortality due to this reason.

## CONCLUSIONS

Application of potential measures is crucial in the evaluation of an epidemiological situation associated with premature mortality. This analysis revealed that in the 15-year study period, diseases of the digestive system contributed to 136,837 deaths (57.2%) in males and 102,339 deaths (42.8%) in females, which corresponded to a loss of 3,651,633.8 YLLs (66.8%) in males and 1,818,463.0 years (33.2%) in females. SEYLLp values due to this cause were 131.4 and 61.3 years, respectively, whereas SEYLLd values were 26.7 and 17.8 years. Diseases of the liver were the greatest factor causing potential loss of life (2,960,998.9 YLLs – 54.1%), which contributed to a loss of 77.6 years per 10,000 males and 27.1 years per 10,000 females. In this group, the dominant role was occupied by fibrosis and cirrhosis of the liver (1,555,827.2 years – 52.5%) and alcoholic liver disease (1,154,722.1 years – 39.0%). In order to minimize this phenomenon, it is important to intensify public health activities, aimed at combating alcohol addiction in Poland.

**Conflicts of interest:** No conflict to declare.

**Authors' contributions:** P.P.G.: statistical analysis, data interpretation, literature search, manuscript preparation; M.K: study design, data

collection, funds collection; I.M.B: study design, literature search, funds collection.

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**Supplementary Table I.** Causes of death in Poland 2000-2014

group of diseases	ICD-10 groups	2000	2001	2002	2003	2004	2005	2006	2007
infectious and parasitic diseases	A, B	866	837	872	816	782	827	886	855
neoplasms	C	36537	37208	37459	38328	38510	39345	39855	40610
diseases of the blood and blood-forming organs	D	1154	1183	1285	1431	1288	1294	1337	1639
endocrine, nutritional and metabolic diseases	E	3458	3396	3400	3395	3364	3408	3774	3825
mental and behavioural disorders	F	246	262	254	314	291	295	265	325
diseases of the nervous system	G	1788	1911	1994	1955	2155	2454	2468	2562
diseases of the eye and adnexa, ear and mastoid process	H	2	1	3	0	2	2	0	1
diseases of the circulatory system	I	91729	91117	89163	90934	88750	88972	88824	90589
diseases of the respiratory system	J	7819	6474	6195	7145	6697	7481	7341	7644
diseases of the digestive system	K	6176	6375	6428	6536	6733	6968	6979	6975
diseases of the skin and subcutaneous tissue	L	32	22	23	15	19	16	24	19
diseases of the musculoskeletal system and connective tissue	M	446	426	396	450	456	419	390	370
diseases of the genitourinary system	N	2028	1961	1997	1946	2090	2288	2436	2331
pregnancy, childbirth and the puerperium, certain conditions originated in perinatal period	O, P	628	601	598	568	539	500	540	537
congenital malformations, deformations and chromosomal abnormalities	Q	695	629	562	527	501	530	442	477
external causes of morbidity, injury, poisoning and certain other consequences of external causes	S, T, V, W, X, Y	6731	6441	6499	6119	6018	6152	6072	5824
other causes of death	R, Z, U	12303	11515	10703	10841	10640	10548	9755	10408
total		172638	170359	167831	171320	168835	171499	171388	174991

**Supplementary Table I. Continued**

group of diseases	ICD-10 groups	2008	2009	2010	2011	2012	2013	2014
infectious and parasitic diseases	A, B	1057	1129	1129	1317	1144	813	821
neoplasms	C	40841	40895	40793	40644	42041	41919	42875
diseases of the blood and blood-forming organs	D	1377	1647	1820	1992	2065	2465	2310
endocrine, nutritional and metabolic diseases	E	4084	4121	3971	4167	4333	4440	4056
mental and behavioural disorders	F	332	283	296	302	301	328	314
diseases of the nervous system	G	2541	2786	2777	2955	3154	3188	2851
diseases of the eye and adnexa, ear and mastoid process	H	1	0	0	0	1	0	1
diseases of the circulatory system	I	91415	94352	92519	90526	94397	94910	90917
diseases of the respiratory system	J	7728	8446	7846	8108	8433	9841	8760
diseases of the digestive system	K	7132	7114	6912	7010	7064	7268	6669
diseases of the skin and subcutaneous tissue	L	16	20	28	50	81	102	117
diseases of the musculoskeletal system and connective tissue	M	387	375	350	407	423	454	431
diseases of the genitourinary system	N	2443	2614	2688	2665	2629	2278	1516
pregnancy, childbirth and the puerperium, certain conditions originated in perinatal period	O, P	567	563	482	401	393	385	356
congenital malformations, deformations and chromoson=mal abnormalities	Q	466	481	435	443	467	424	432
external causes of morbidity, injury, poisoning and certain other consequences of external causes	S, T, V, W, X, Y	6018	5658	5397	5427	5576	5434	5201
other causes of death	R, Z, U	10653	10630	11202	10909	10192	11367	13049
total		177058	181114	178645	177323	182694	185616	180676