EPIDEMIOLOGICAL STUDY OF THE AREA OF INTEREST

AIR TRITIA 2018

Processed under the project "SINGLE APPROACH TO THE AIR POLLUTION MANAGEMENT SYSTEM FOR THE TRITIA FUNCTIONAL AREA OF TRITIA (hereinafter referred to as AIR TRITIA), No CE1101, co-financed by the European Union through Interreg CENTRAL EUROPE.

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List of Abbreviations

AQMS	Systém řízení kvality ovzduší (Air Quality Management System)
BaP	Benzo(a)pyren (Benzo(a) pyrene)
CZ	Česká republika (Czech Republic)
ČSÚ	Český statistický úřad (Czech Statistical Office)
ES	Evropské společenství (European Commonwealth)
ESÚS	Evropské seskupení pro územní spolupráci (European Grouping of Territorial Cooperation)
ESÚS TRITIA	Evropské seskupení pro územní spolupráci TRITIA s ručením omezeným (European Grouping for Territorial Cooperation with limited liability)
EU	Evropská Unie (European Union)
EPA	Agentura pro ochranu životního prostředí (Environmental Protection Agency)
FUA	Funkční městská oblast (Functional urbanisation area)
GUS	Główny Urząd Statystyczny (Main Statistical Office)
IS	Index stáří (Age index)
LAU	Místní správní jednotky (Local Administrative Units)
MHD	Městská hromadná doprava (Public transport)
MSK	Moravskoslezský kraj (Moravian-Silesian Region)
NO_x	Oxidy dusíku (Nitrogen Oxide)
NUTS	Soustava územních statistických jednotek (Nomenclature of Units for Territorial Statistics)
OECD	Organizace pro hospodářskou spolupráci a rozvoj (Organisation for Economic Co-operation and Development)
ORP	Obec s rozšířenou působností (Municipality with Extended Competence)
OW	Opolské vojvodství (Opole Voivodeship)
PL	Polsko (Poland)
PM	Polétavý prach (Particulate Matter)
PPP	Parita kupní síly (Purchasing Power Parity)
PWS	Systém predikce a varování (Prediction and Warning System)
R2 nebo R^2	Koeficient determinace (Determination coefficient)
REZZO	Registr emisí a zdrojů znečištění ovzduší (Emissiona and Air Pollution Register)
SDR	Standardizovaná míra úmrtnosti (Standardized Mortality Rate)
SK	Slovensko (Slovakia)
SO_2	Oxid siřičitý (Sulfur Dioxide)
SUSR	Štatistický úrad Slovenskej republiky (Statistical Office of the Slovak Republic)
SW	Slezské vojvodství (Silesian Voivodeship)
UK	Spojené království Velké Británie a Severního Irska (United Kingdom of Great Britain and Northern Ireland)

USA	Spojené státy americké (United States of America)
VKO	Velikostní kategorie obce (Municipality Size Category)
VÚC	Vyšší územní celek (Higher Territorial Unit)
ZSK	Žilinský samosprávný kraj (Zilina's self-governing region)
ŽP	Životní prostředí (Environment)
SDR	Standardizovaná míra úmrtnosti (Standardized Mortality Rate)

Variables for Analysis and Modeling

- A00_Y98 – total standardized mortality
- C00_C97 - standardized mortality due to malignant tumors
- C33_C34 - standardized mortality due to traumatic tumors of the trachea, bronchus and lungs
- I00_I99 - standardized mortality due to cardiovascular diseases
- J00_J99 – standardized mortality due to respiratory diseases
- J40_J47 - standardized mortality due to chronic lower respiratory tract disease
- E_T – number of people who have completed education
- E_Uni – number of people with university education
- E_Hig – number of people with secondary education
- E_Voc – number of people with vocational education
- E_Pri – number of people with basic education
- E_N – number of people without education
- UnE_A – number of unemploeyed persons
- UnE_R – percentage of unemployed persons
- popul – number of people living in given location
- PM10 – the amount of larger particulate matters in the air
- PM25 – the amount of smaller particulate matters in the air
- NOx - the amount of nitrogen oxides in the air
- BAP – the amount of benzo(a)pyrene in the air

Introduction

The Epidemiological Study has been elaborated within the framework of the UNIQUE APPROACH TO THE AIR TRITIA AIR POLLUTION MANAGEMENT SYSTEM IN THE TRITIA AREA (hereinafter referred to as AIR TRITIA), No. CE1101, which is aimed at increasing the capacities and possibilities of public administration for decision-making and air pollution solutions. This will improve air quality in the TRITIA region with a focus on selected cities whose air quality is influenced by sources from neighboring countries. The aim of the socio-economic study is to map the impact of air pollution on selected diagnoses. The data from the EUROSTAT database at NUTS-2 level were used to map the TRITIA situation. For a more detailed analysis of the area, a unique database of health data at the LAU-1 level (districts and powiaty) was created within the AIR TRITIA project, which contains data on the number of deaths for pre-specified diagnoses in each age group. On the basis of these data, it was possible to determine the standardized mortality rate for the LAU-1 statistical territorial units across the borders of 3 states.

A/Main inputs:

1. The output of the project is the elaboration of an air quality management strategy proposal for the TRITIA area. The strategy will include technical, legislative and other proposals with a strong focus on a common approach and international cooperation among the different parts of the TRITIA region in the Czech Republic, Slovakia and Poland.
2. Drafting 5 strategies for 5 partner cities, namely Ostrava, Opava, Opole, Rybnik, Žilina. It will also include measures to quantify impacts, including assessing the effectiveness of air pollution relief instruments.

B/Created applications:

1. **AQMS – Air quality management system:** AQMS is a professional system that includes relevant spatial data, results of analyzes, results of air pollution modeling, measures, impact of measures on air quality. It includes a single spatial database extended by the proposed measures and the impact of the measures on air quality. Information will be accessed via interactive map interfaces. The system will be calibrated for Ostrava.
2. **PWS – Prediction and Warning System**: PWS will provide model air pollution information 48 hours in advance. The forecasts will be based on air monitoring and meteorological data detailed for each of the 5 cities. It will focus mainly on situations with extreme air pollution. Information will be accessible through a web browser and smartphone application.

C/ Foundation analysis, models and studies:

1. **Socio-economic study**: Population distribution study by socio-economic characteristics, including long-term analysis.
2. **Epidemiological study**: Assessment of the condition with regard to the health status of the population, with particular reference to respiratory diseases, circulatory diseases and cancer.
3. **Study about the causes of air pollution:** A summary of the current knowledge of the causes of air pollution in the TRITIA region in the 5 cities, including the mapping of measures to improve air quality.
4. **Analysis of national legislation and policies to improve air quality**: Analysis of National Policies and Legislative Regulations, including immediate change, with a special focus on national and regional pollution control, at national, regional and local levels.
5. **Analysis of current EU-funded projects in the field of air pollution:** Report with summary information on similar projects and their results. Recommendations for the AIR TRITIA.
6. **Air pollution model:** Distribution model of average concentrations of PM10, PM2,5, NO2, benzo (a) pyrene in the TRITIA region and 5 cities.
7. **Health risks calculations**: Report on health risks associated with air pollution based on calculation of the model's result according to EPA methodology.

1 The Area of Interest Specification

1.1 ESÚS TRITIA

The TRITIA European Territorial Cooperation Group (EGTC TRITIA) was established on 25th February 2013 on the basis of a decision of the Ministry of Foreign Affairs of the Republic of Poland (MFA) No. 1/2013 on the registration of EGTC TRITIA in the Register of European Groupings for Territorial Cooperation led by the MFA. The legal basis of EGTC TRITIA is Regulation (EC) No 1082/2006 of the European Parliament and of the Council of 5th July 2006 on the European Grouping of Territorial Cooperation (EGTC), which was transposed into Polish legislation by the Law on 7th November 2008 on the European Grouping of Territorial Cooperation.

The decision to establish the EGTC TRITIA was adopted in 2009 by representatives of the higher territorial self-governing units from the Moravian-Silesian Region (CZ), the Opole Voivodeship (PL), the Silesian Voivodeship (PL) and the Zilina's self-governing region (SVK) and the steps leading to its establishment were commenced. The decision was based on the positive experience of the regions in cross-border cooperation and on the impacts of this cooperation on improving the life people living on the border.

The EGTC TRITIA was based on facilitating and expanding cross-border, transnational and interregional cooperation among its members in order to strengthen economic and social cohesion, in particular, through the implementation of territorial cooperation projects or programs with the following objectives:

1. Faciliating the everyday life of the Group’s residents
2. Creating cross-border territorial cohesion
3. Realization of projects for joint strategic development

To achieve these objectives, the EGTC implements tasks aimed at identifying, promoting and implementing programs, projects and joint decisions in territorial cooperation in four key areas:

1. Transportation
2. Economy
3. Tourism
4. Energy with a focus on renewable energy sources

and in five complementary areas:

1. Culture
2. Environment
3. Human resources, education including a close cooperation with universities
4. Cooperation between public institutions and the implementation of exchanges of persons and experience in international internships
5. Sport

Opole Voivodeship has terminated its membership in ESUS TRITIA, i.e. this study includes the territory all founding members. The area of interest for the AIR TRITIA project consists of four **higher self-governing units**, **which we will generally refer to as the regions**: Opole Voivodeship (PL), Silesian Voivodeship (PL), Moravian-Silesian Region (CZ) and Zilina self-governing region (SVK). The territory of the EGTC TRITIA has an area of 34 069 km^2, with more than 7.4 million inhabitants.

2 Methodology

2.1 Terms Definition

Analyzes of population health status and country comparisons use indicators of the frequency of the disease in the population, where prevalence and incidence are among the basic ones. The basic view of differences in the health status of the population is the analysis of mortality from routinely monitored data. These data are provided by individual countries of Europe to Eurostat, the European Union Statistical Office. They are available at national level but also in a more detailed breakdown of regions within NUTS2 regions. Always with a certain delay (2-3 years), all deaths in the given territory are broken down by causes, so-called specific mortality. In order to be able to compare populations of different sizes, in addition to the absolute numbers of deaths, the average population (as of 1st of the given year) is also recalculated and mortality is most often expressed in the number of deaths per 100,000 inhabitants per year. When comparing 2 or more populations, it is not enough to recalculate the population because each population has a different age structure. Different methods of standardization are used to eliminate differences in the age structure of the population - most often to the model age structure of the European or world population. Standardized Death Rate (SDR) allows for an unbiased comparison of populations that differ in their age structure. In this study, the overall standardized mortality (European standard) and SDR for the most serious disease (broken down by cause of disease according to the International Classification of Diseases - ICD-10) are analyzed, for which a possible link to air pollution can be hypothetically assimilated. They are:

- total SDR
- SDR for malignant tumors (C00–C97)
- SDR for malignant tumors of of the trachea, bronchi and lungs (C33-C34)
- SDR for cardiovascular diseases (I00-I99)
- SDR for respiratory diseases (J00-J99)
- SDR for chronic lower respiratory tract disease (J40-J47)

Methodological problems in comparing data from individual national databases

For comparisons between countries, the available data from EUROSTAT were used, which are methodologically harmonized. The problem is that they are harmonized only at NUTS-2 level, so it was necessary to obtain source data from individual providers that would be available at LAU-1 level for more detailed analysis of the polluted areas. In particular, the data were acquired from the Institute of Health Information and Statistics of the Czech Republic (HISI), the Polish Statistical Office (GUS) and the Slovak Statistical Office (SÚSR), data on mortality according to individual categories were collected according to selected gender diagnoses, and data on the age structure of the population. The standardized mortality rate (SDR) was then calculated. Great attention was paid to data cleansing and identification of anomalies; the resulting data was harmonized by spatial correlation. For the overall assessment of the impact of the environment on diseases according to specified diagnoses, it is necessary to come out from the model of air pollution, which was prepared by VŠB-TU Ostrava.

2.2 Data Analysis Methods

The study uses data analysis methods and multidimensional data analysis. In addition to the descriptive methods used to identify basic data on the selected population, more advanced statistical methods are also used. First of all, it is a **correlation** (estimated by Pearson's correlation coefficient), which is used to quantify the degree of linear dependence between pairs of variables. The resulting values range from -1 to 1 and values close to 0 are considered as insignificant dependencies.

In addition to correlation, a **multidimensional linear regression model** is used for multiple dependencies. The aim of the regression is to find out which factors affect the described dependent variable and, on the contrary, which factors do not affect the described variable.

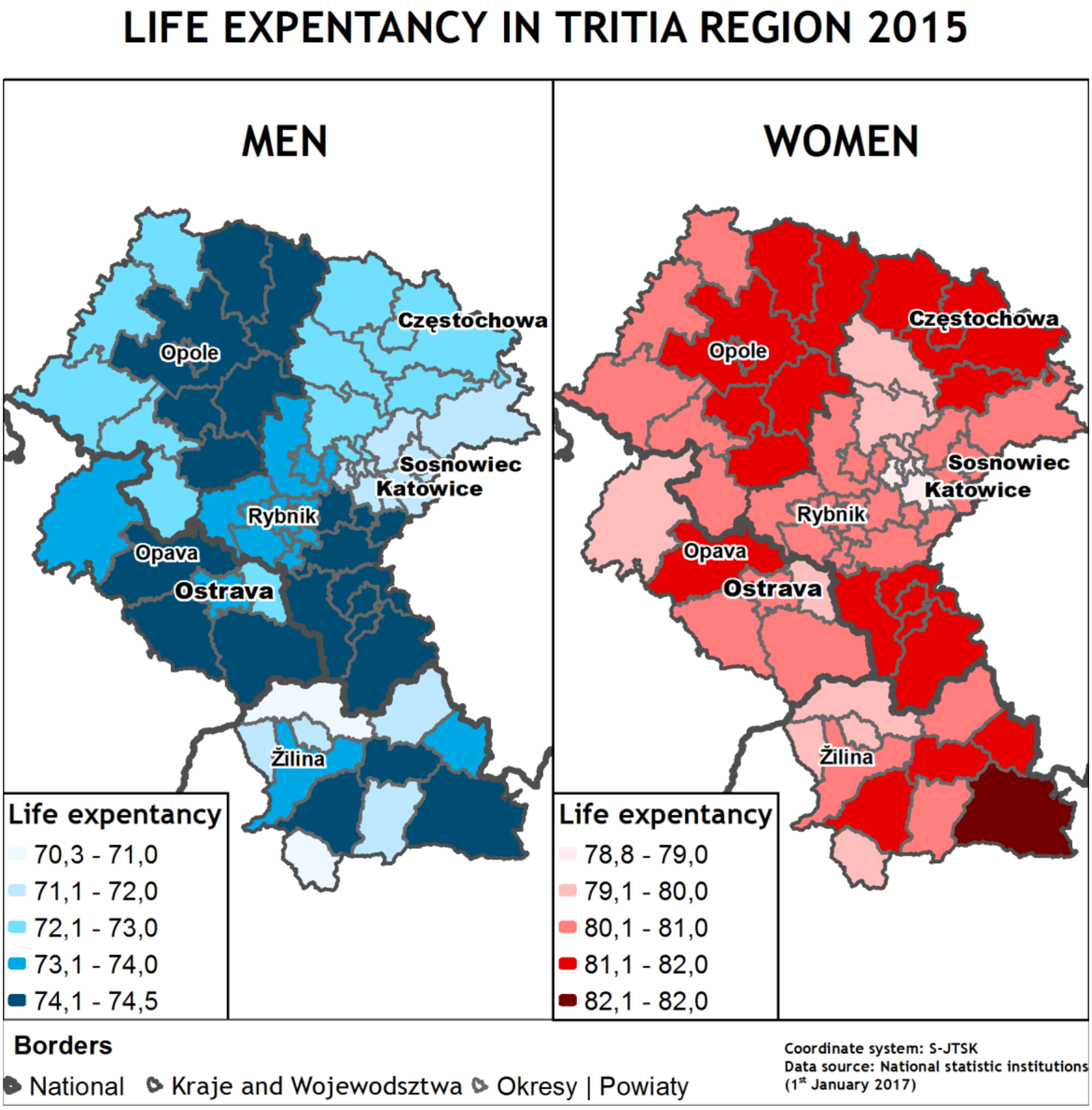
3 Basic Demographic Characteristics of the Area of Interest

3.1 Mid Life Expectancy

Life expectancy at birth is the number of years that a person born, just in the course of a given period, is likely to experience. Life expectancy is generally higher for women than for men.

Within Poland, men have the highest survival expectancy (over 74 years) in the Opole subregion (eastern part of the Opole Voivodeship) and in the south of the Silesian Voivodeship in the subregions of Bílý and Tyský, the lowest in the Katovický and Sosnovecký subregions. On the Czech side in MSK, men have the highest survival expectancy in the districts of Frýdek-Místek, Nový Jičín and Opava, at least in the district of Karviná. In the Žilina region, men from the districts of Liptovský Mikuláš, Dolný Kubín and Martin have the highest life expectancy, the lowest in the district of Čadca. For women, the spatial distribution of life expectancy does not differ significantly from that of the male population, but we can observe the differences in all the regions surveyed.

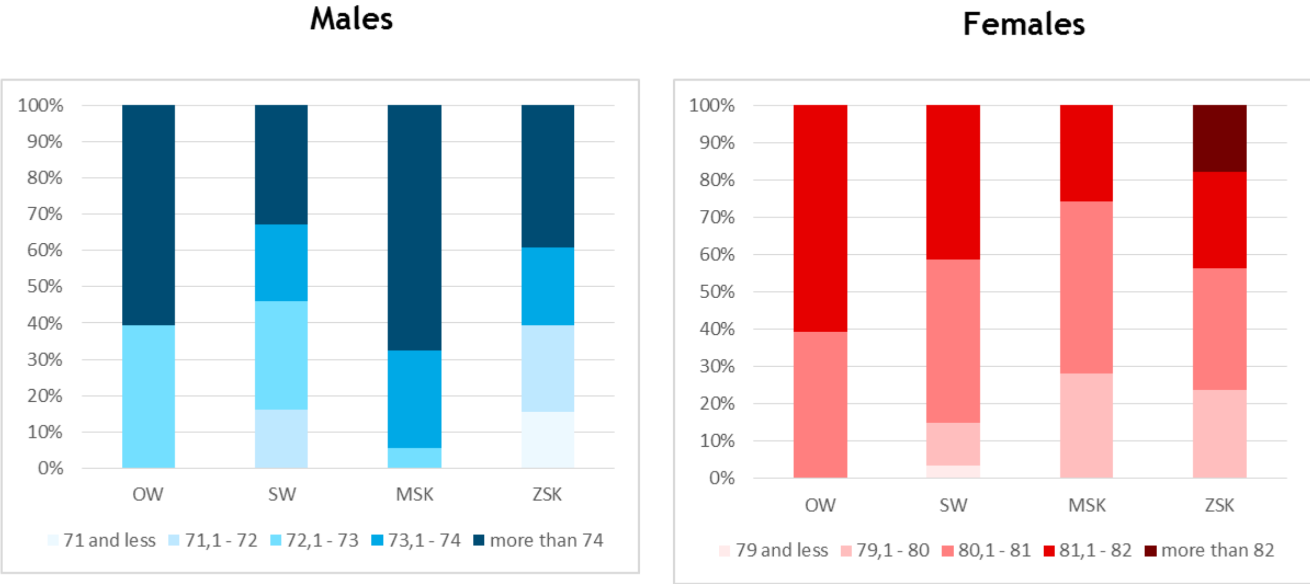
Figure 3.1: Life expectancy by gender at the LAU-1 spatial level in 2006 and 2016



Source: ČSÚ, SÚSR, GUS, own processing

Note: The scales of the individual maps were defined by the uniform intervals for each gender.

Figure 3.2: Representation of municipalities by life expectancy by gender (2015) Representation of municipalities by life expectancy by gender (2015)



Source: ČSÚ, SÚSR, GUS, own processing

4 Mortality Rate Analysis

4.1 European Union's States Analysis

For the analysis of the overall mortality (for all deaths) and specific mortality differences, the most recent Eurostat data for the 3-year average of standardized mortality for 2013-2015 was available in geographical breakdown at NUTS 2 level.

Total mortality

The total standardized mortality rate for both genders in EU 28countries (EU28 - member countries in 2015) was 1,022.54/100,000 residents. A significantly higher average was the male SDR (1,275.56) compared to women (835.59). Also, the individual countries and regions (NUTS 2) within the EU significantly differed according to the overall mortality. Total SDR was higher than the average of EU 28countries in the countries surveyed; the Czech Republic and Poland reached comparable values (1275.22 and 1274.27) and in Slovakia it reached significantly higher values (1387.23). The order of the most significant causes of death did not differ in the three countries studied - the most common cause of death in both genders was cardiovascular disease, followed by malignant tumors (CNS), respiratory system diseases, lung cancer (lung, lungs and lungs according to ICD-10) and last of the most frequent causes of death were chronic diseases of the lower respiratory tract (Table 6.1). The same cause of death rate was also found for each gender separately, but men's SDR values were higher than women's. When comparing country-specific SDRs for both genders, highest cardiovascular and respiratory mortality rates and malignant tumors were found in Slovakia, while in Poland they had higher SDR values for lung cancer, in the Czech Republic, there were deaths for chronic lower respiratory tract diseases. When comparing the male mortality, the highest value was SDR for cardiovascular causes of Slovak men, the lowest SDR occurred in Polish men and was related to chronic lower respiratory tract illness. Standardized mortality rates of women showed the highest and lowest values in the same countries and for the same causes (Table 4.1).

Analysis of the differences between European regions by gender shows that the values of the total and all monitored female mortality rates are lower than the regional SDRs for a given group of diseases of both genders, whereas (logically) male SDRs were higher in all cases (Table 4.1) standardized male mortality increases both overall and specific mortality rates for the monitored groups of diagnoses if we do not take into account gender differences.

Table 4.1: Causes of death. Standardized mortality, 3-year average - total and selected specific mortality by gender 2013-2015 (in NUTS 2 regions of the European Union) - national values in the monitored area

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases
EU28 - European Union Total	1 022,54	261,66	54,33	380,9	83,45	34,74
EU28 - European Union Males	1 275,56	348,99	85,03	452,68	118,51	52,33
EU28 - European Union Females	835,59	200,87	31,04	324,86	62,65	24,23
Czech Republic Total	1 275,22	284,28	53,59	638,14	80,62	39,19
Czech Republic Males	1 604,09	381,64	86,4	761,68	117,6	59,78
Czech Republic Females	1 044,01	219,84	30,02	548,89	58,36	26,44
Poland Total	1 274,27	296,41	69,05	612,41	76,47	23,36
Poland Males	1 683,99	415,18	117,89	758,65	120,01	41,92
Poland Females	992,31	223,52	36,59	509,73	52,73	13,45
Slovakia Total	1 387,23	323,75	50,8	676,12	84,37	24,18
Slovakia Males	1 781,38	464,54	94,38	806,14	129,7	42,17
Slovakia Females	1 118,88	236,97	22,39	583,19	59,36	14,37

Source: EUROSTAT, 2018

When comparing each NUTS 2 within the EU, the lowest total gender mortality was found in the Spanish region of the Comunidad de Madrid (741.43), with the highest total mortality rate exceeding the EU 28 average by, more than double - in the Bulgarian region Severozapaden (1 755.86) (Table 4.2).

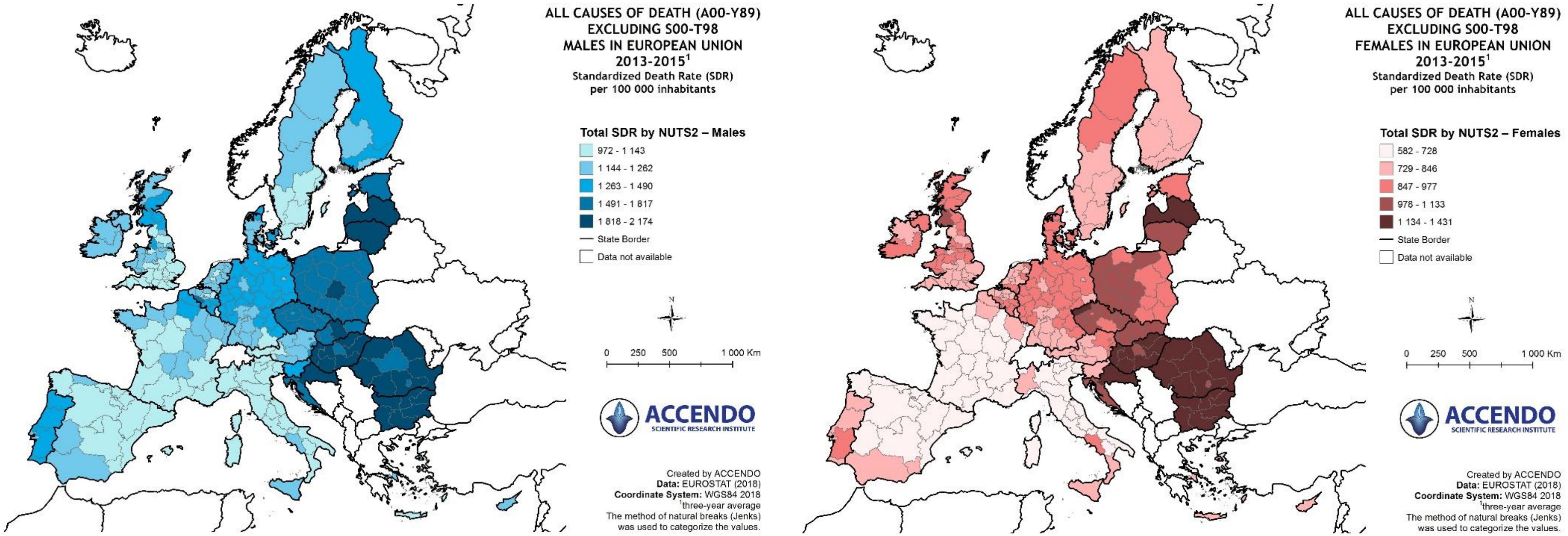
When comparing differences between European regions by gender, the overall and all observed female mortality rates were lower than the regional SDRs for a given gender group, while (logically) the SDRs were higher in all cases (Table 1) - a high standardized mortality of men increases both overall and specific mortality rates for the monitored groups of diagnoses if we do not take into account gender differences.

4.1.1 Total SDR

Higher overall mortality rates for both men and women in each NUTS 2 are in the former socialist countries from the Baltic to Black Sea, where, especially in the south-eastern part of Europe, there is cumulation of the regions with the highest mortality rates for both men and women. On the other hand, the lowest total mortality rates of both genders were found in most areas in France, Italy, Spain and the south of Great Britain and Sweden (Figure 4.1).

Total mortality was lowest in the French Île de France (972.07) and highest in the Bulgarian region of Northozapaden (2.174,17). The lowest SDR of all causes for women was found in the Spanish Comunidad de Madrid (581.76) and the highest in the Serbian region of Serbia (1.431,44) (Table 4.2).

Figure 4.1: Total standardized mortality of men and women in the European Union in the period of 2013-2015



Data source: EUROSTAT, 2018, own processing

Table 4.2: Standardized mortality, 3-year average - total and selected specific mortality rates by gender 2013-2015 in NUTS 2 regions with the lowest and highest value found

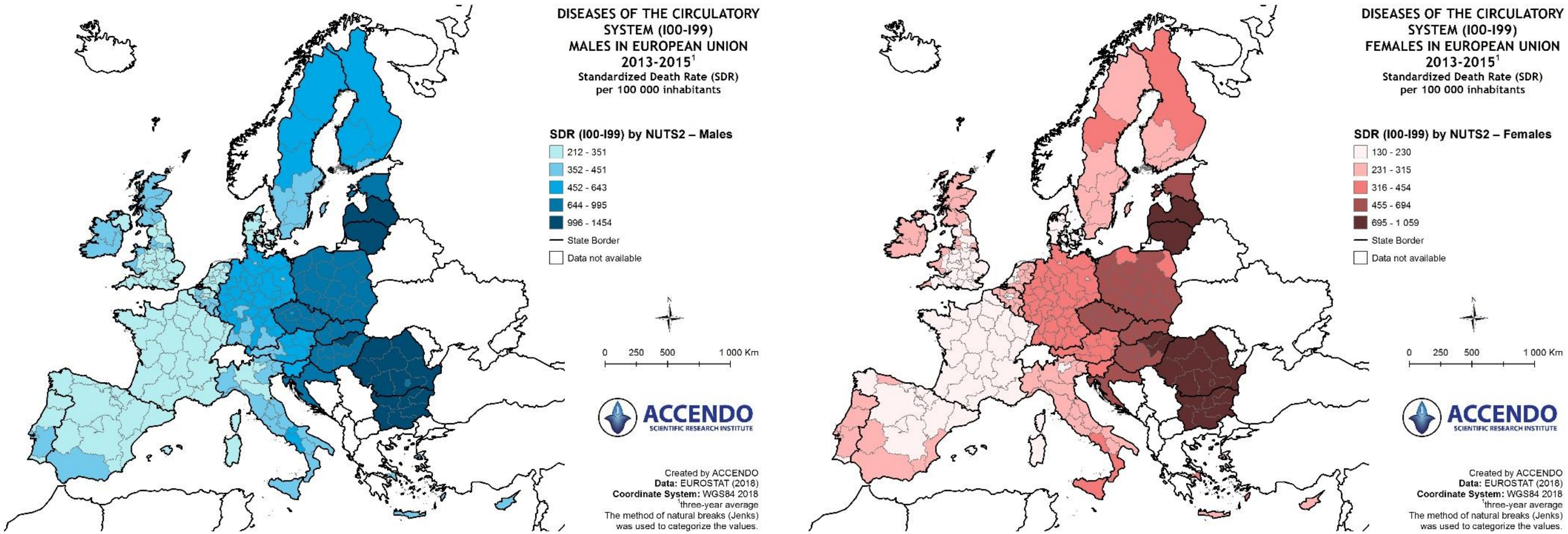
		GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
Total	Min	ES30 - Comunidad de Madrid	741,43					
	Max	*BG31 - Severozapaden*	*1 755,86*					
Males	Min	FR10 - Île de France	972,07					
	Max	*BG31 - Severozapaden*	*2 174,17*					
Females	Min	ES30 - Comunidad de Madrid	581,76					
	Max	*RS - Serbia*	*1 431,44*					
Total	Min	FRA3 - Guyane		174,00				
	Max	*HU23 - Dél-Dunántúl*		*367,02*				
Males	Min	LI - Liechtenstein		232,32				
	Max	*HU31 - Észak-Magyarország*		*511,37*				
Females	Min	FRA3 - Guyane		121,77				
	Max	*UKM3 - South Western Scotland*		*289,69*				
Total	Min	FRA1 - Guadeloupe			14,45			
	Max	*HU32 - Észak-Alföld*			*98,16*			
Males	Min	FRA1 - Guadeloupe			22,58			
	Max	*HU32 - Észak-Alföld*			*161,55*			
Females	Min	FRA1 - Guadeloupe			8,05			
	Max	*UKM3 - South Western Scotland*			*81,43*			
Total	Min	FR10 - Île de France				162,96		
	Max	*BG31 - Severozapaden*				*1 225,61*		
Males	Min	FR10 - Île de France				211,54		
	Max	*BG31 - Severozapaden*				*1 454,20*		
Females	Min	FR10 - Île de France				130,02		
	Max	*BG34 - Yugoiztochen*				*1 058,63*		
Total	Min	FI1C - Etelä-Suomi					31,56	
	Max	*PT30 - Região Autónoma da Madeira*					*287,87*	
Males	Min	FRA1 - Guadeloupe					50,83	
	Max	*PT30 - Região Autónoma da Madeira*					*396,59*	
Females	Min	FI1C - Etelä-Suomi					18,79	
	Max	*PT30 - Região Autónoma da Madeira*					*236,73*	
Total	Min	FRA2 - Martinique						6,15
	Max	*HU31 - Észak-Magyarország*						*91,32*
Males	Min	FRA2 - Martinique						10,29
	Max	*HU31 - Észak-Magyarország*						*140,72*
Females	Min	FRA2 - Martinique						3,75
	Max	*UKD7 - Merseyside*						*78,25*

Source: EUROSTAT, 2018. Note: Marked in green are the *lowest NUTS 2 values for both sexes and given SDR are shown in the following white box of maximum values for SDRs of both* genders; *in the blue NUTS2 box with the lowest male values for that SDR and the next white maximum value field; in the NUTS 2 purple box with the* minimum SDR for women and in the *white* are the *maximum*

4.1.2 Circulatory System Diseases

Similarly, to total mortality, the mortality rate of the circulatory system, one of the most important causes of death, not only within Europe but also in other countries of the world, is also reflected in the comparison of NUTS 2 regions. Again, the highest SDR for circulatory disease is found in the southeastern regions of Europe, with higher values in former socialist countries where values have consistently manifested in most territories. The lowest mortality rates for cardiovascular causes occurred in the western part of Europe, namely in France, Spain and England for both genders (Figure 4.2).

Figure 4.2: Standardized mortality of men and women from circulatory diseases in the European Union in the period 2013-2015



Data source: EUROSTAT, 2018, own processing

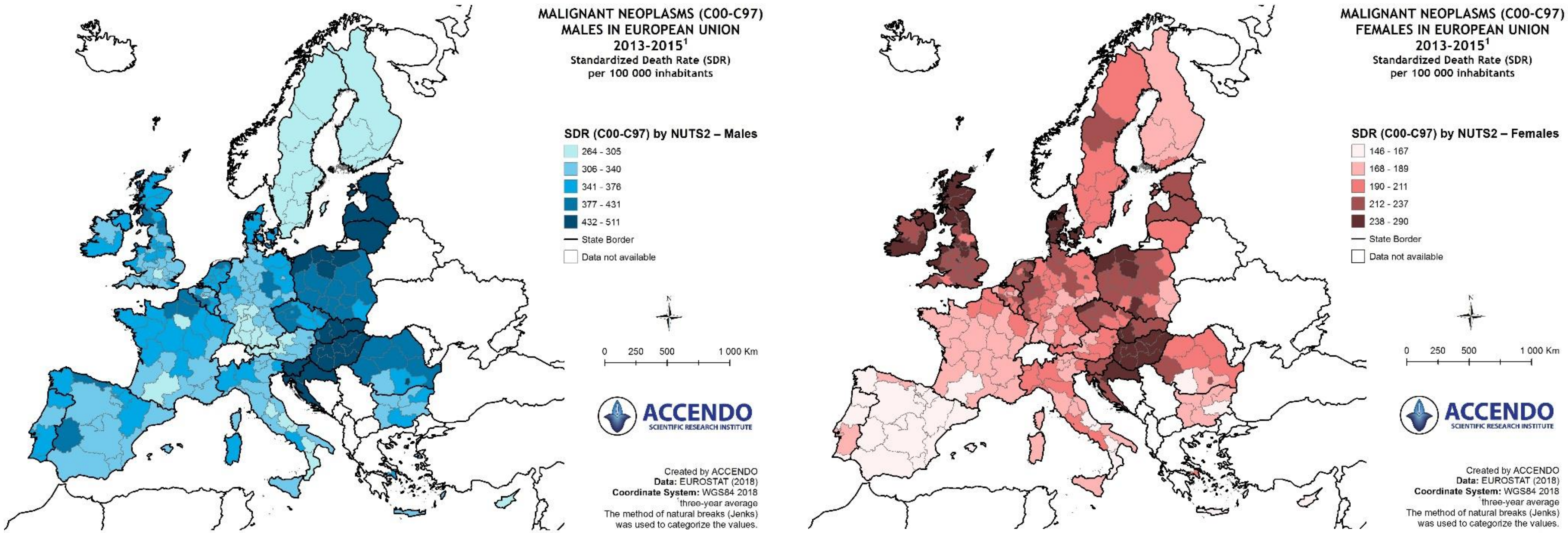
The standardized mortality rate for circulatory diseases of both genders was the lowest in the Île de France (162.96), the highest in the Bulgarian Northozapaden (1,225.61). In the French NUTS 2 Île de France, the lowest mortality rate was observed for circulatory diseases in all European NUTS 2 regions, both males (211.54) and females (130.02), while the highest mortality was due to cardiovascular mortality in the Bulgarian regions in the Severozapaden region for men (1,454.20) and in the Yugoiztochen region for women (1.058,63) (Table 4.2).

4.1.3 Tumorous Diseases

Another of the most serious causes of death is death from malignant cancer. Particularly in Eastern European countries, there is a higher specific mortality rate on male malignancies (Fig. 4.3); in women with high SDR for malignant tumors, NUTS2 mainly concerns the territory of Hungary, Croatia, Denmark and some regions of Scotland.

The lowest standardized mortality rate for tumors for both genders was identified in French Guyana (174.00), the highest in the Hungarian Dél-Dunántúl (367.02). For men, the lowest death rate for malignant tumors was also found in Liechtenstein (232.32), and for women it was again the French Guyana (121.77), the highest SDR values were found in the specific male mortality rates in the Hungarian NUTS2 Észak-Magyarország and women in the southwestern region Scotland (UKM3).

Figure 4.3: Standardized mortality of men and women from tumoros diseases in the European Union in the period 2013-2015



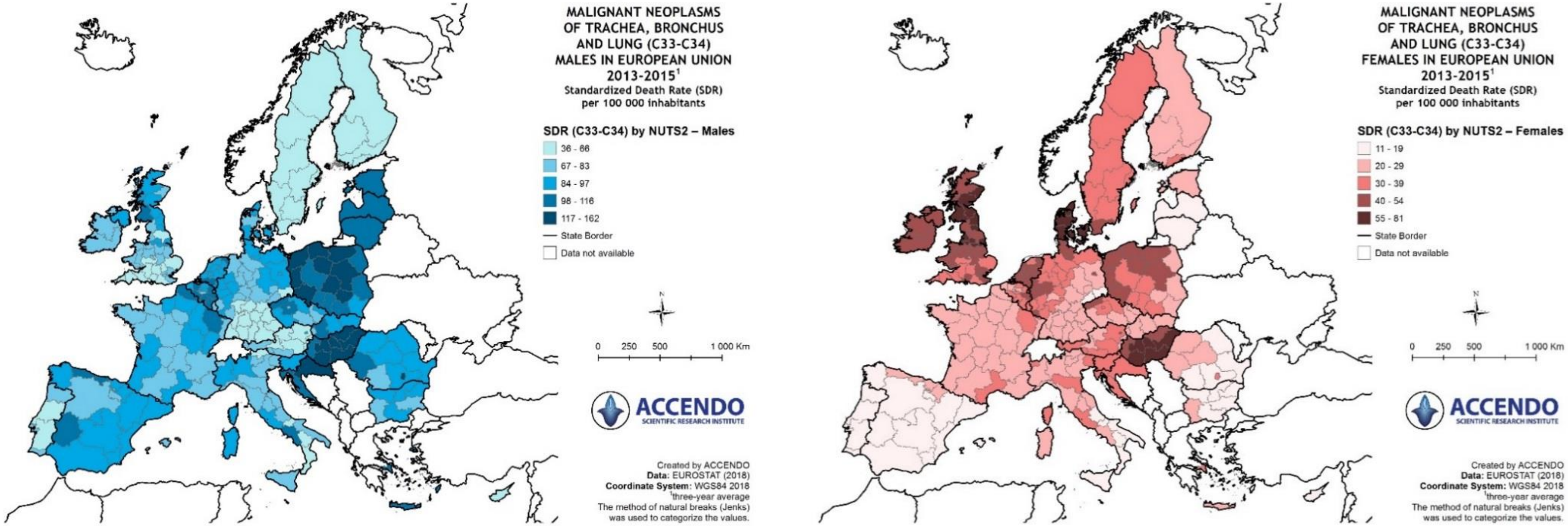
Data source: EUROSTAT, 2018, own processing

4.1.4 Malignant Lung Tumors

Specifically, malignant lung tumors (dg C33-C34 - malignant tumors of the trachea, bronchus and lungs) are specifically evaluated. Their main causes are exposure to pollutants in the work environment, and smoking, however the differences of this specific SDR in relation to environmental pollution are being analyzed. In view of these dominant exposure, caution should be exercised in correlating analyzes of these data. As with total mortality in malignant tumors, even in SDR for male lung cancer, the highest mortality rate in Europe appears in the range from the Baltic republics across the territory of Poland and Hungary to Croatia. In the SDR of women with lung cancer, the highest values were recorded in NUTS2 of Hungary, Denmark and Scotland, as well as in total mortality on malignant tumors (Figure 4.4).

The most positive finding for SDR for lung cancers of both genders was detected in Guadeloupe, France (14.45), and the worst mortality rate in the Hungarian NUTS2 Észak-Alföld (98.16), nearly seven times the 3-year average of the French region (Tab. 4.2). The same NUTS2 occurs at the lowest and highest values of men's SDRs whose values exceed seven times. In women, the lowest death rate in lung cancer is also found in Guadeloupe (8.05) in France, but the worst situation is again in the south-west of Scotland (81.43), as well as in the total SDR for malignant tumors, and in the case of SDR for Sclera values represent ten times the values in Guadeloupe (Table 4.2). The most positive finding for SDRs for lung cancers of both genders was detected in Guadeloupe, France (14.45), and the worst mortality rate in the Hungarian NUTS2 Észak-Alföld (98.16), almost seven times the 3-year average of the French region.

Figure 4.4: Standardized mortality of men and women in tracheal, bronchial and lung cancer in the European Union in the period 2013-2015



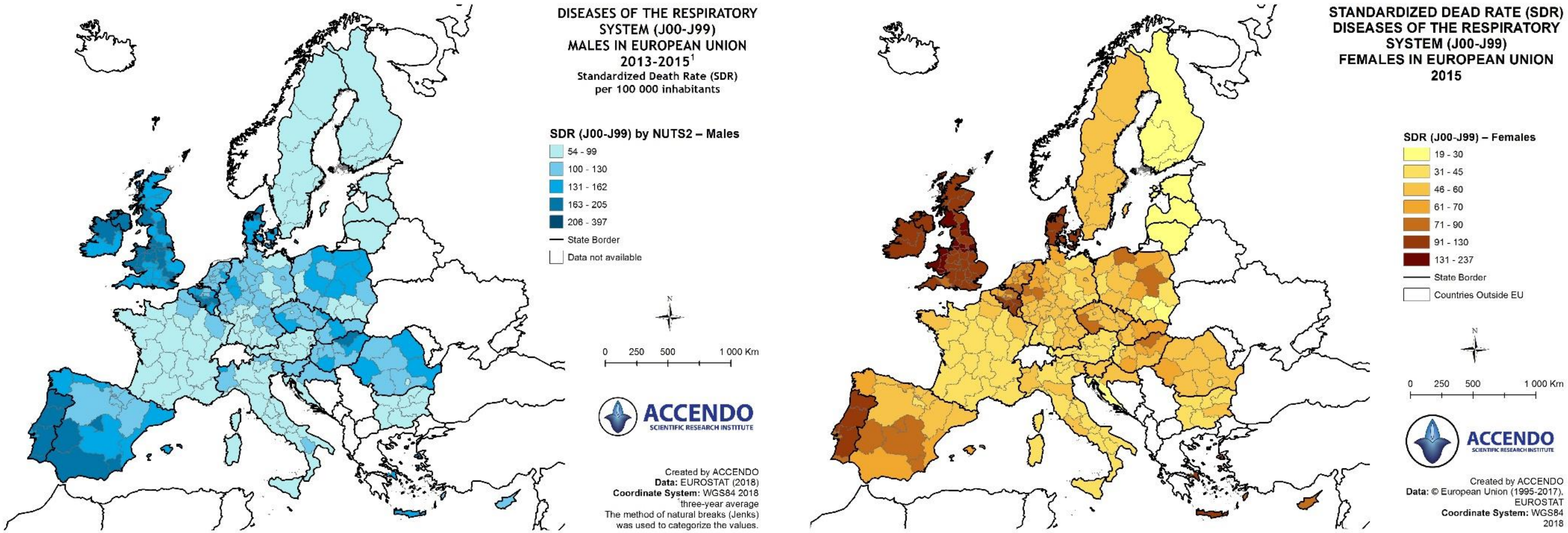
Data source: EUROSTAT, 2018, own processing

4.1.5 Respiratory System Diseases

In the comparison of European NUTS2 according to the 3-year average of standardized mortality for respiratory diseases, the comparison of eastern European countries with other EU countries is considerably better than in previous groups of diagnoses of the disease. The highest SDR for respiratory diseases in males is found in the UK, Ireland, Spain and Portugal, and much more pronounced within the European NUTS2 is the high SDR for these diseases in women in the British Isles, Ireland, Denmark and Portugal (Figure 4.5).

SDR for male and female respiratory diseases was the lowest in Etelä-Suomi (31.56) in Finland, the highest in Região Autónoma da Madeira (287.87) in Portugal, where they are 9 times higher compared to Finnish NUTS2. When assessing SDRs for respiratory diseases specifically for men and women, again the highest values are found in the region of Madeira, the best values of SDR for men are based in Guadeloupe, the EU's outermost region located in the Caribbean, the women's region was again the Finnish region of Etelä-Suomi (Table 4.2).

Figure 4.5: Standardized mortality of men and women from respiratory diseases in the European Union in the period 2013-2015



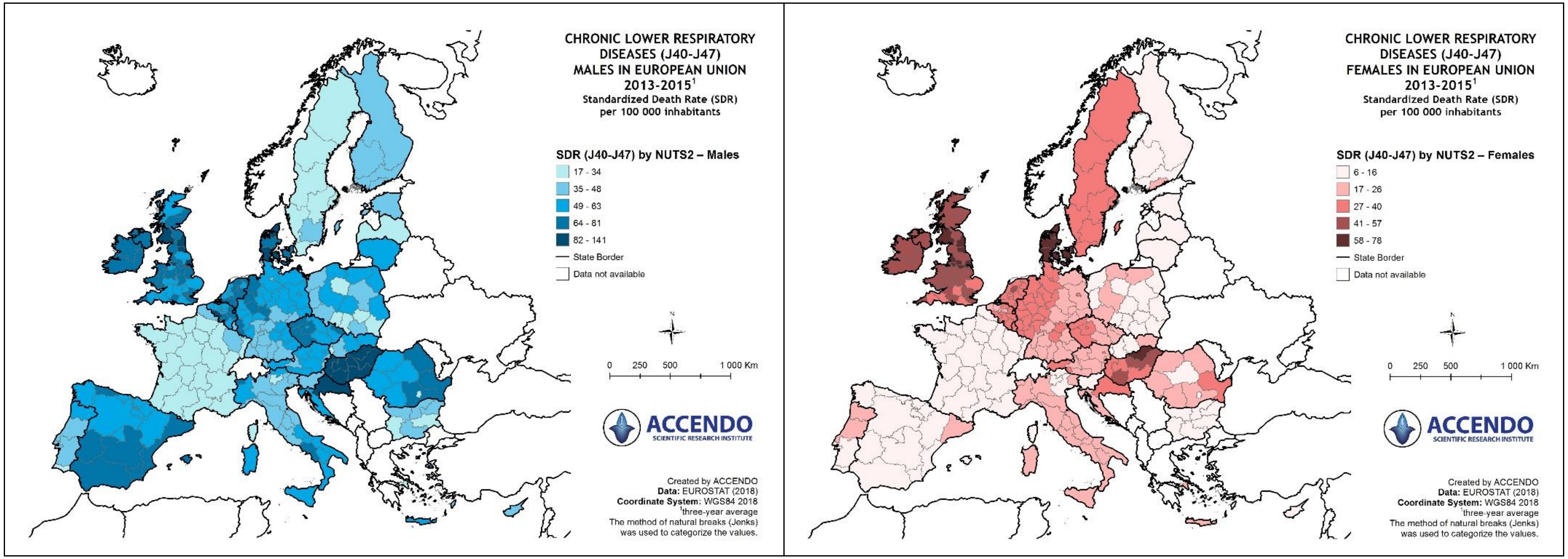
Data source: EUROSTAT, 2018, own processing

4.1.6 Disease of the Lower Respiratory Tract

Mortality in lower respiratory tract mortality rates in European comparisons appears in the increased values of some NUTS2 in the strip from the British Isles via the countries of Western, Central and Eastern Europe, particularly in Hungary for both genders and individually in southern regions of Spain for men and Sweden for women (Figure 4.6).

The lowest standardized mortality rate of both genders from chronic lower respiratory disease was evident in Martinique (6.15) and highest in the Hungarian region Észak-Magyarország (91.32) - almost fifteen times the value of Martinique. As with the combined values for both genders, the lowest SDR for chronic lower respiratory tract diseases was found in both men and women in Martinique (Table 4.2). The highest SDR values for lower respiratory tract illnesses for both genders and especially for men were identified in the Hungarian region Észak-Magyarország, the highest value for women in the Merseyside Northwest England region (Table 4.2). This area was warned by the European Commission in 2017, along with 15 other areas, to reduce air pollution.

Figure 4.6: Standardized mortality of men and women from lung, bronchial and lung cancer in the European Union in 2013-2015



Data source: EUROSTAT, 2018, own processing

4.2 TRITIA Region Analysis

The TRITIA region includes the territory of one NUTS2 in the territory of the Czech Republic (CZ08) and Slovakia (SK03) and two regions in the territory of Poland (PL22 and PL52). The total standardized mortality and specific mortality rates for each diagnosis are compared in interest NUTS2 with European Union values and national national values. In Tables 4.3-4.5, ocular boxes highlight the values in each NUTS2 that exceed national values. The most common are mortality on malignant tumors and cardiovascular disease. Compared to the European Union average, the SDRs above both regional and country values, for both genders and SDR by gender, are higher. For some specific mortality rates for both genders, the values were better than the EU average, e.g. SDR for lung cancer in the Czech Republic and Moravia-Silesia region, Slovakia and NUTS2 Central Slovakia or SDR for chronic respiratory diseases in Poland and both Polish NUTS2 and Slovakia; NUTS2 Central Slovakia (Table 4.3).

Table 4.3: Total and selected specific mortality rates of both genders in EU28, CR, Poland and Slovakia and NUTS2 in TRITIA region

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Total	Total	Total	Total	Total	Total
EU28 - European Union (2015)	**1 022,54**	**261,66**	**54,33**	**380,9**	**83,45**	**34,74**
CZ - Czech Republic	***1 275,22***	***284,28***	***53,59***	***638,14***	***80,62***	***39,19***
CZ08 - Moravskoslezsko	1 375,61	291,85	52,54	709,37	93,01	40,58
PL - Poland	***1 274,27***	***296,41***	***69,05***	***612,41***	***76,47***	***23,36***
PL22 - Slaskie	1 334,65	307,91	63,75	679,58	57,92	14,63
PL52 - Opolskie	1 274,22	276,41	57,96	611,3	69,88	19,29
SK - Slovakia	***1 387,23***	***323,75***	***50,8***	***676,12***	***84,37***	***24,18***
SK03 - Stredné Slovensko	1 409,14	318,98	50,73	691,68	90,48	28,09

Data source: EUROSTAT, 2018

Table 4.4: Total and selected specific mortality rates of men in EU28, CR, Poland and Slovakia and NUTS2 in TRITIA region

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Males	Males	Males	Males	Males	Males
EU28 - European Union (2015)	**1 275,56**	**348,99**	**85,03**	**452,68**	**118,51**	**52,33**
CZ - Czech Republic	***1 604,09***	***381,64***	***86,4***	***761,68***	***117,6***	***59,78***
CZ08 - Moravskoslezsko	1 754,64	395,1	88,89	848,82	144,65	69,14
PL - Poland	***1 683,99***	***415,18***	***117,89***	***758,65***	***120,01***	***41,92***
PL22 - Slaskie	1 693,30	417,01	106,79	806,07	86,63	24,69
PL52 - Opolskie	1 658,24	387,68	101,52	771,74	102,51	33,28
SK - Slovakia	***1 781,38***	***464,54***	***94,38***	***806,14***	***129,7***	***42,17***
SK03 - Stredné Slovensko	1 847,28	471,60	96,16	829,57	145,5	50,8

Data source: EUROSTAT, 2018, own processing

Table 4.5: Total and selected specific mortality of women in EU28, CR, Poland and Slovakia and NUTS2 in the TRITIA Region

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory systém (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Females	Females	Females	Females	Females	Females
EU28 - European Union (2015)	**835,59**	**200,87**	**31,04**	**324,86**	**62,65**	**24,23**
CZ - Czech Republic	**1 044,01**	**219,84**	**30,02**	**548,89**	**58,36**	**26,44**
CZ08 - Moravskoslezsko	1 110,63	223,92	27,55	607,94	64,06	24,68
PL - Poland	***992,31***	***223,52***	***36,59***	***509,73***	***52,73***	***13,45***
PL22 - Slaskie	1 070,13	239,46	34,49	581,22	40,81	8,95
PL52 - Opolskie	1 004,12	205,98	29,06	501,7	50,61	11,7
SK - Slovakia	***1 118,88***	***236,97***	***22,39***	***583,19***	***59,36***	***14,37***
SK03 - Stredné Slovensko	1 118,88	227,09	21,64	595,33	60,59	15,68

Data source: EUROSTAT, 2018, own processing

The TRITIA region includes the territory of one NUTS2 in the territory of the Czech Republic (CZ08) and Slovakia (SK03) and two regions in the territory of Poland (PL22 and PL52). The total standardized mortality and specific mortality rates for each diagnosis are compared in interest NUTS2 with European Union values and national values. In Tables 4.3-4.5, ocular boxes highlight the values in each NUTS2 that exceed national values. The most common are mortality on malignant tumors and cardiovascular disease. Compared to the European Union average, the SDRs above both regional and country values, for both genders and SDR by gender, are higher. For some specific mortality rates for both genders, the values were better than the EU average, e.g. SDR for lung cancer in the Czech Republic and Moravia-Silesian region, Slovakia and NUTS2 Central Slovakia or SDR for chronic respiratory diseases in Poland and both Polish NUTS2 and Slovakia; NUTS2 Central Slovakia (Table 4.3).

Table 4.6: Total and selected specific mortality rates of both genders in EU28, CR, Poland and Slovakia and NUTS2 in TRITIA region

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Total	Total	Total	Total	Total	Total
EU28 - European Union (2015)	**1 022,54**	**261,66**	**54,33**	**380,9**	**83,45**	**34,74**
CZ - Czech Republic	***1 275,22***	***284,28***	***53,59***	***638,14***	***80,62***	***39,19***
CZ08 - Moravskoslezsko	1 375,61	291,85	52,54	709,37	93,01	40,58
PL - Poland	***1 274,27***	***296,41***	***69,05***	***612,41***	***76,47***	***23,36***
PL22 - Slaskie	1 334,65	307,91	63,75	679,58	57,92	14,63
PL52 - Opolskie	1 274,22	276,41	57,96	611,3	69,88	19,29
SK - Slovakia	***1 387,23***	***323,75***	***50,8***	***676,12***	***84,37***	***24,18***
SK03 - Stredné Slovensko	1 409,14	318,98	50,73	691,68	90,48	28,09

Data source: EUROSTAT, 2018, own processing

Table 4.7: Total and selected specific mortality rates of men in EU28, CR, Poland and Slovakia and NUTS2 in TRITIA region

GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory system (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Males	Males	Males	Males	Males	Males
EU28 - European Union (2015)	**1 275,56**	**348,99**	**85,03**	**452,68**	**118,51**	**52,33**
CZ - Czech Republic	***1 604,09***	***381,64***	***86,4***	***761,68***	***117,6***	***59,78***
CZ08 - Moravskoslezsko	1 754,64	395,1	88,89	848,82	144,65	69,14
PL - Poland	***1 683,99***	***415,18***	***117,89***	***758,65***	***120,01***	***41,92***
PL22 - Slaskie	1 693,30	417,01	106,79	806,07	86,63	24,69
PL52 - Opolskie	1 658,24	387,68	101,52	771,74	102,51	33,28
SK - Slovakia	***1 781,38***	***464,54***	***94,38***	***806,14***	***129,7***	***42,17***
SK03 - Stredné Slovensko	1 847,28	471,60	96,16	829,57	145,5	50,8

Data source: EUROSTAT, 2018, own processing

Table 4.8: Total and selected specific mortality rates of women in EU28, CR, Poland and Slovakia and NUTS2 in TRITIA region

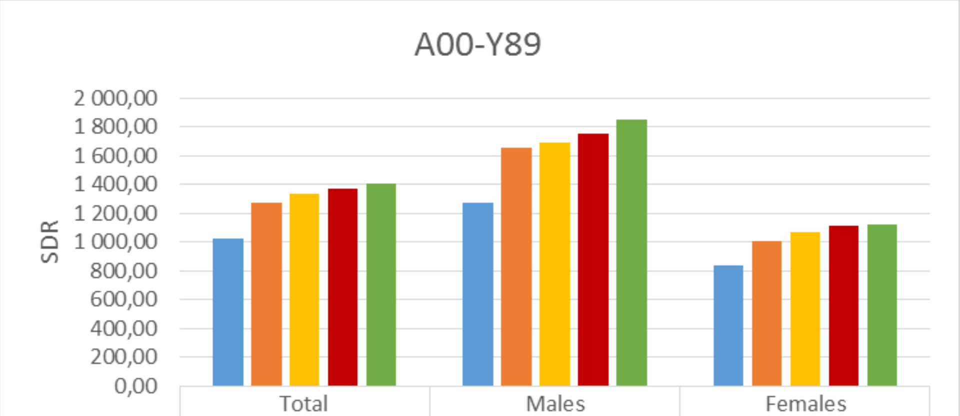
GEO/ICD10	All causes of death (A00-Y89) excluding S00-T98	Malignant neoplasms (C00-C97)	Malignant neoplasm of trachea, bronchus and lung (C33-C34)	Diseases of the circulatory systém (I00-I99)	Diseases of the respiratory system (J00-J99)	Chronic lower respiratory diseases (J40-J47)
	Females	Females	Females	Females	Females	Females
EU28 - European Union (2015)	**835,59**	**200,87**	**31,04**	**324,86**	**62,65**	**24,23**
CZ - Czech Republic	**1 044,01**	**219,84**	**30,02**	**548,89**	**58,36**	**26,44**
CZ08 - Moravskoslezsko	1 110,63	223,92	27,55	607,94	64,06	24,68
PL - Poland	***992,31***	***223,52***	***36,59***	***509,73***	***52,73***	***13,45***
PL22 - Slaskie	1 070,13	239,46	34,49	581,22	40,81	8,95
PL52 - Opolskie	1 004,12	205,98	29,06	501,7	50,61	11,7
SK - Slovakia	***1 118,88***	***236,97***	***22,39***	***583,19***	***59,36***	***14,37***
SK03 - Stredné Slovensko	1 118,88	227,09	21,64	595,33	60,59	15,68

Data source: EUROSTAT, 2018, own processing

4.2.1 Analysis of Differences in Health Indicators within Study Areas

The overall standardized mortality exceeds EU values for both genders in total, as well as for individual genders in all areas surveyed. The highest values are achieved in Central Slovakia, the lowest in the Opole Voivodeship, followed by the Silesian Voivodeship and the Moravian Silesian region - see Figure 4.7.

Figure 4.7: Total standardized mortality in the EU and NUTS2 region of TRITIA broken down by gender

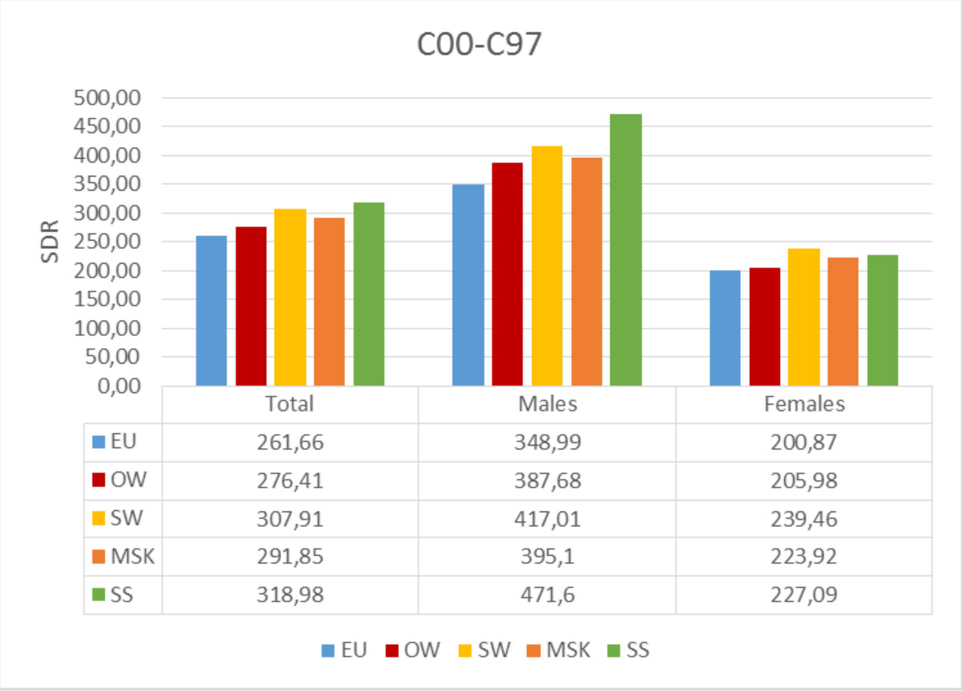


	Total	Males	Females
EU	1 022,54	1 275,56	835,59
OW	1 274,22	1 658,24	1 004,12
SW	1 334,65	1 693,3	1 070,13
MSK	1 375,61	1 754,64	1 110,63
SS	1 409,14	1 847,28	1 118,88

Data source: EUROSTAT, 2018, own processing

Mortality rates for cancer are again higher than the EU average, highest in the Central Slovakia with the highest SDRs for men in this area (471.6). The lowest SDR values for ZN are reached in the Opole Voivodeship, followed by Moravia-Silesian region and the Silesian Voivodeship - Figure 4.8.

Figure 4.8: SDR for malignant cancers in the EU and NUTS2 of the TRITIA region broken down by gender

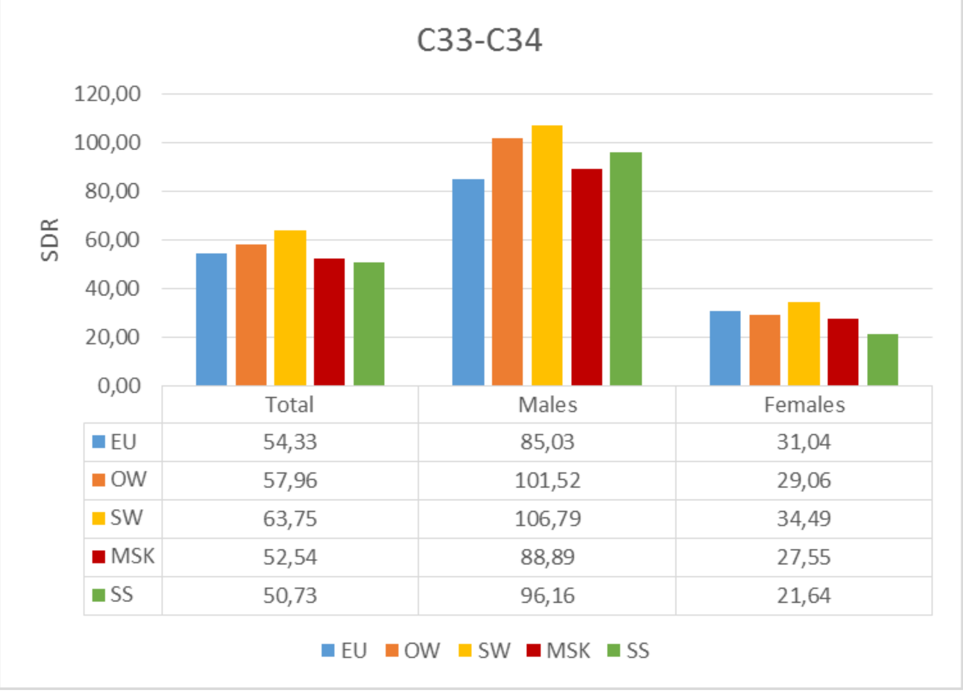


	Total	Males	Females
EU	261,66	348,99	200,87
OW	276,41	387,68	205,98
SW	307,91	417,01	239,46
MSK	291,85	395,1	223,92
SS	318,98	471,6	227,09

Data source: EUROSTAT, 2018, own processing

The specific standardized lung cancer mortality is lower than the EU average in the Central Slovakia and the Moravian-Silesian region for both genders, which is due to lower women's SDRs for these malignancies. The lower death rate of women is also reflected in the Opole Voivodeship. By contrast, EU values are exceeded for men's SDRs in all surveyed areas - Figure 4.9.

Figure 4.9: SDR for lung cancer in the EU and NUTS2 of the TRITIA region broken down by gender

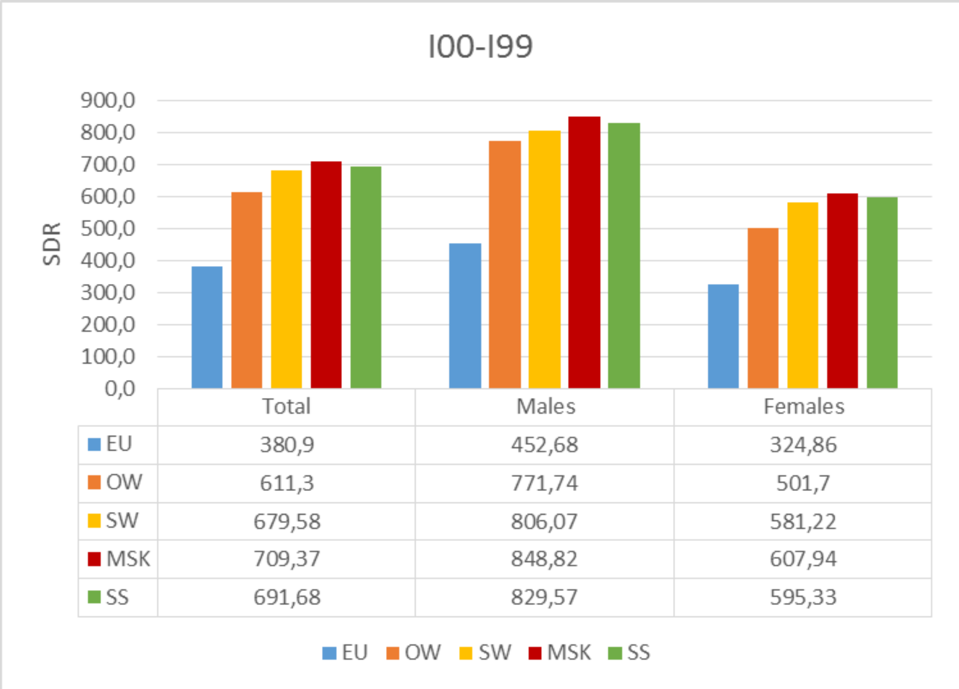


	Total	Males	Females
EU	54,33	85,03	31,04
OW	57,96	101,52	29,06
SW	63,75	106,79	34,49
MSK	52,54	88,89	27,55
SS	50,73	96,16	21,64

Data source: EUROSTAT, 2018, own processing

The greatest difference between the EU average is in mortality for cardiovascular disease - the EU SDR values significantly exceeded in all areas monitored and by gender. The highest values were found this time in Moravia-Silesian region, followed by Central Slovakia, the Silesian Voivodeship and the best situation in the Opole Voivodeship - Figure 4.10.

Figure 4.10: SDR for cardiovascular disease in the EU and NUTS2 region of TRITIA broken down by gender

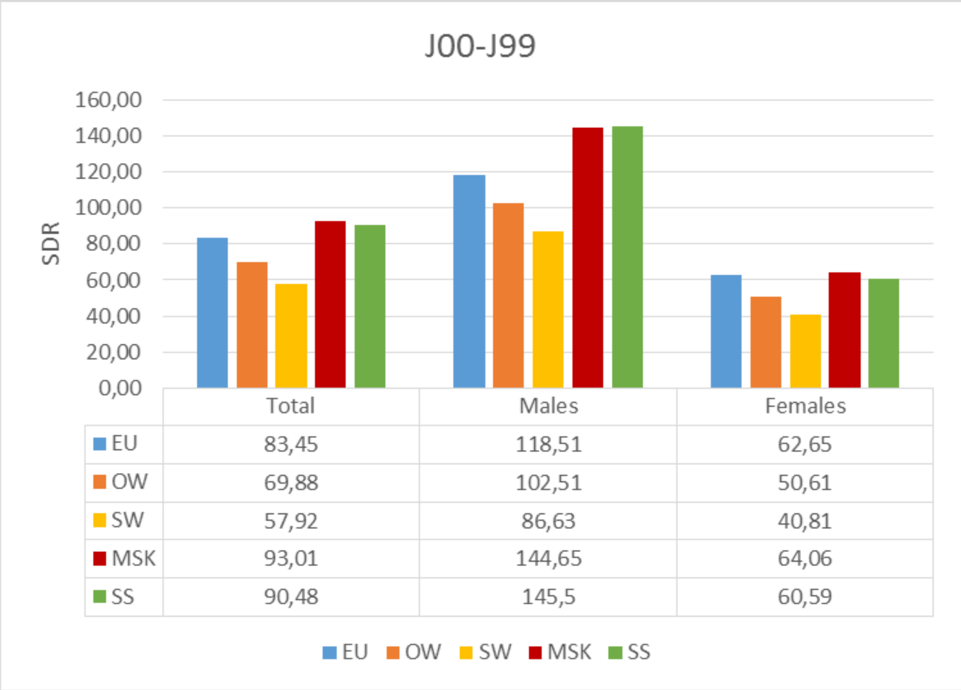


	Total	Males	Females
EU	380,9	452,68	324,86
OW	611,3	771,74	501,7
SW	679,58	806,07	581,22
MSK	709,37	848,82	607,94
SS	691,68	829,57	595,33

Data source: EUROSTAT, 2018, own processing

Significant variability is shown by SDR values for respiratory diseases - in the Silesian Voivodeship, the values are the most favorable, but values in the Opole Voivods are lower than the EU average. By contrast, the standardized mortality of both genders due to respiratory diseases in Moravia Silesian region exceeded both the values of other areas and the EU values, as well as the SDRs of both genders and men in Central Slovakia - Figure 4.11.

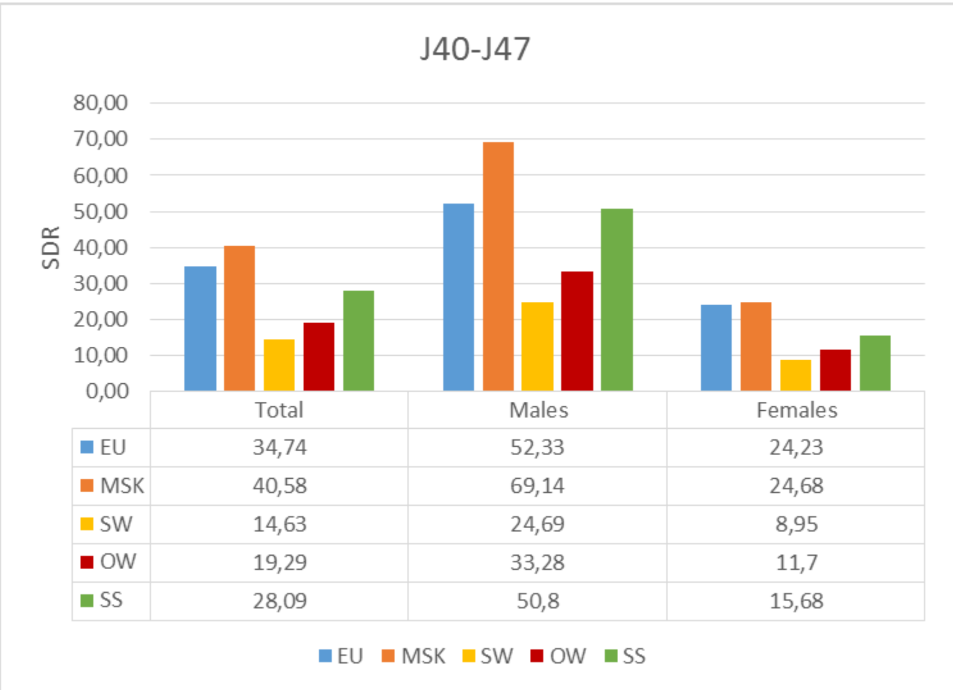
Figure 4.11: SDR for respiratory disease in the EU and NUTS2 of the TRITIA region broken down by gender



Data source: EUROSTAT, 2018, own processing

Previous results on respiratory disease mortality are even more pronounced when comparing SDRs for chronic lower respiratory disease - see the following figure.

Figure 4.12: SDR for chronic lower respiratory tract disease in the EU and NUTS2 region TRITIA broken down by gender



Data source: EUROSTAT, 2018, own processing

Data analysis was further conducted for the lowest geographic breakdown, i.e. LAU1, for which mortality data were obtained. Again, SDR was calculated using the European standard population. These calculations were made for the years 2007, 2011 and 2015. From the data Tab. 9.1 in the appendix it is clear that SDR values fluctuate considerably, especially for the causes of lower deaths that entered the SDR calculation - for example, for chronic lower respiratory tract disease (J40-J47). In cases of zero frequencies in all age categories, this result was excluded from the results of analyses because of the missing data, especially when the SDR differed by 2 orders of magnitude in the two analyzed years and thus served as data control. Given that no time series data is available, it is not possible to assess the trend over the period 2007-2015, although some SDR values may suggest it. SDR values for the dg group J40-J47 are however listed in Tab. 4.9. in LAU1 with the best and worst SDRs, but for the reasons above they should be judged with a certain margin. Other outputs only relate to 2015 as the latest available information.

Table 4.9: Highest and lowest SDR values in each of the LAU1 monitored areas in 2015

Sex	Cause of death	The worst results		The best results	
		SDR	LAU-1	SDR	LAU-1
Total	A00-Y98	1762,5	Ostrava-město	1034,1	Opole
	C00-C97	93,8	Świętochłowice	25,7	Oleski
	C33-C34	93,8	Świętochłowice	25,7	Oleski
	I00-I99	825,1	Ostrava-město	412,6	Zabrze
	J00-J99	190,3	Turčianske Teplice	32,3	Piekary Śląskie
	J40-J47	67,5	Bruntál	0,9	Pszczyński
Men	A00-Y98	2196,4	Ostrava-město	1277,8	Zabrze
	C00-C97	564,2	Bytča	312,6	Nový Jičín
	C33-C34	184,6	Turčianske Teplice	38,6	Oleski
	I00-I99	1079,6	Námestovo	459,6	Zabrze
	J00-J99	381,5	Kysucké Nové Mesto	49,3	Mikołowski
	J40-J47	147,5	Kysucké Nové Mesto	1	Bielsko-Biała
Women	A00-Y98	1450,1	Ostrava-město	824,2	Opole
	C00-C97	328,4	Siemianowice Śląskie	149,1	Głubczycki
	C33-C34	63,5	Świętochłowice	6,1	Rybnicki
	I00-I99	783,9	Bruntál	365	Zabrze
	J00-J99	179,2	Turčianske Teplice	19,8	Piekary Śląskie
	J40-J47	42,5	Bruntál	1,2	Bielsko-Biala

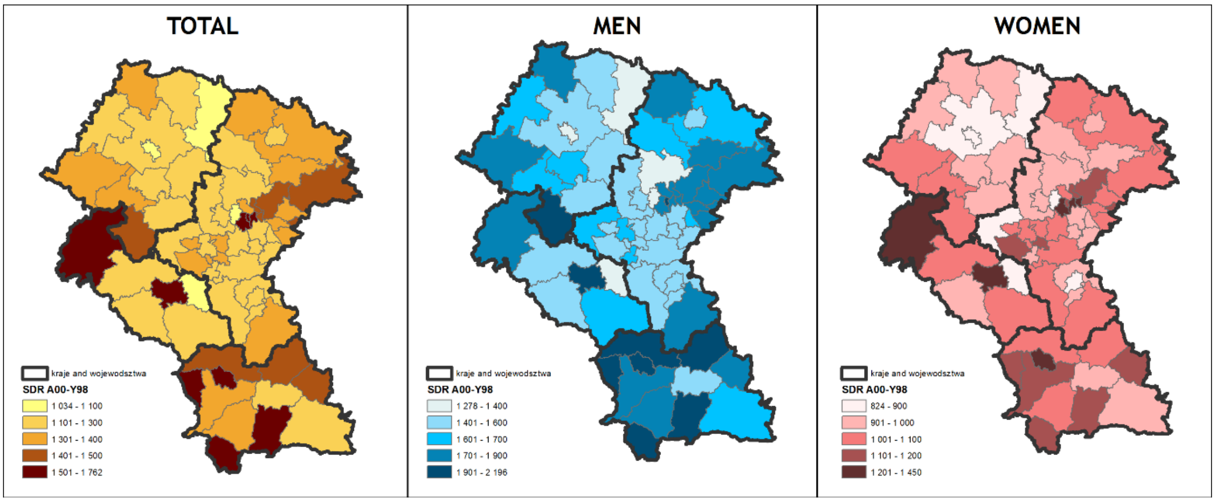
Source: ÚZIS, SÚSR, GÚS, 2018, own processing

Note: The individual LAU-1s are color-coded in the table by region / province as follows:

	MORAVIAN-SILESIAN REGION		*OPOLE VOIVODESHIP*
	SILESIAN VOIVODESHIP		*ZILINA SELF-GOVERNING REGION*

Absolutely the highest SDR values for all causes were found in the Ostrava-city district for men, women and there are common values for both genders. The best values related to the Opole Voivodeship for total SDRs of both genders and women, and the Zabrze district in the Silesian Voivodeship (Table 4.9). From the graphical representation on the maps of Figure 4.13, it is clear that high SDR values for both genders occur in other areas of the LAU1 of the Žilina Region, as well as SDR analysis for each gender separately. The Opole Voivodeship are the most favorable in terms of SDRs of both genders and women, in total mortality of men, the value of some LAU1 come close to the other territories of other areas of LAU1.

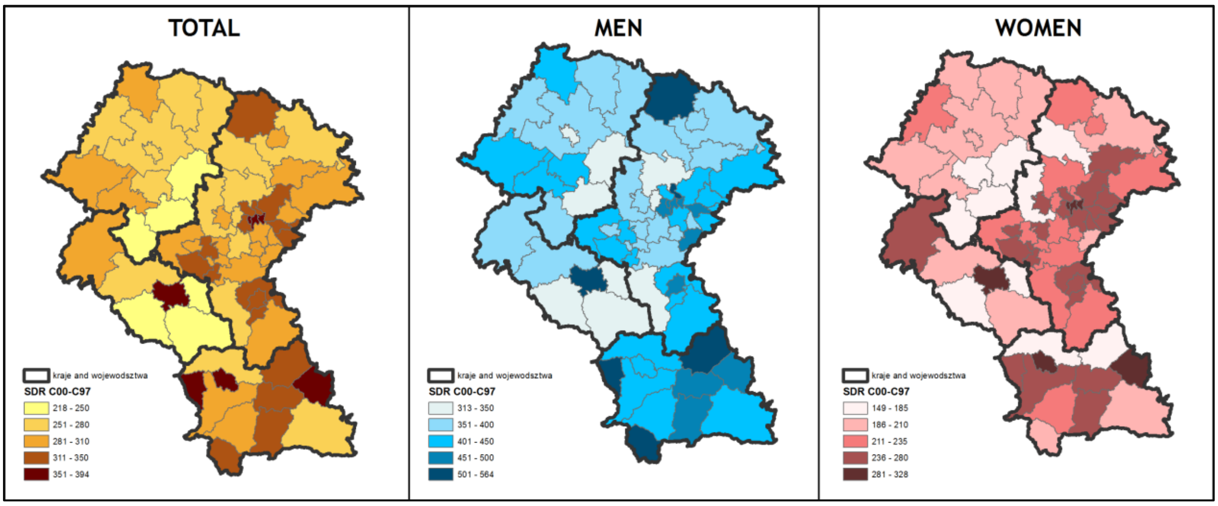
Figure 4.13: Total standardized mortality in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

Standardized mortality on malignant tumors shows the absolute highest values for both genders and women in Silesian regions (Swietochlowice and Siemianowice Slaskie). On the contrary, the best values are again in Opole areas Oleski and Glubczycki (for both genders, and women). The SDR for malignant tumors was the highest in the district of Bytča in Žilina and the lowest in the district Nový Jičín (Table 4.9). The graphical comparison of the LAU1 areas in Figure 4.14 shows that again the Ostrava district and some regions of the Žilina region are involved in the increased SDRs for malignant diseases in both genders, followed by the regions of the Silesian Voivodeship. Similarly, SDR outputs for each gender are also shown separately.

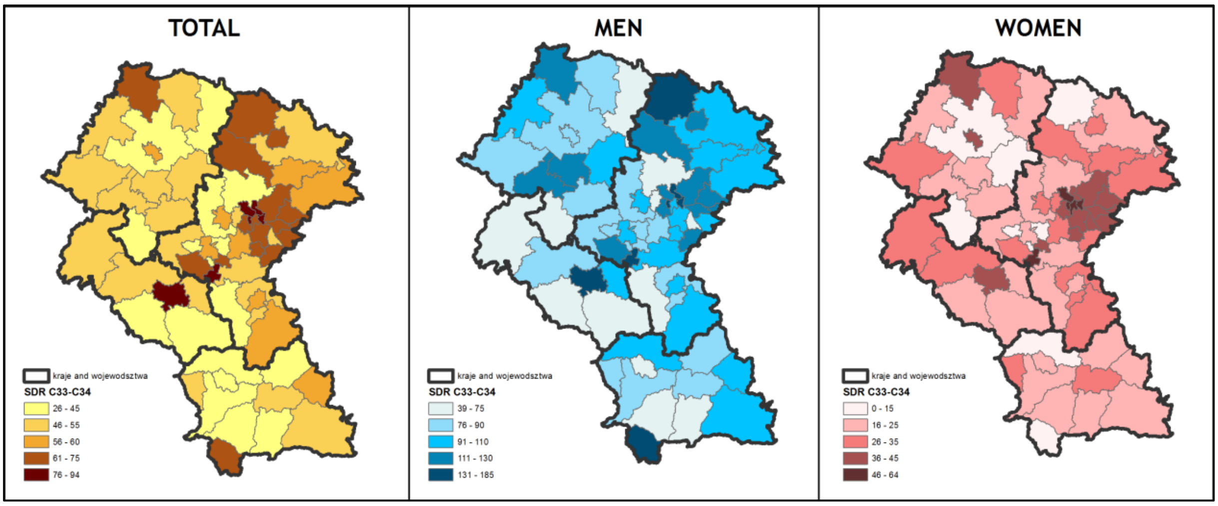
Figure 4.14: SDR for malignant tumors in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

When assessing lung cancer mortality, absolute values for both genders and women are reached in the Silesian regions of Swietlochowice and for men in the district of Turcianske Teplice (Table 4.9). The lowest values for SDR for lung tumors reached Oleski (for both genders) and Rybnicki powiat (for women). In the graphical comparison (Figure 4.15) of the individual LAU1, it is clear that the worse values for both genders concentrate predominantly in the Silesian Voivodeship, but in the assessment of each gender it is obvious that the heterogeneity of individual areas is much greater.

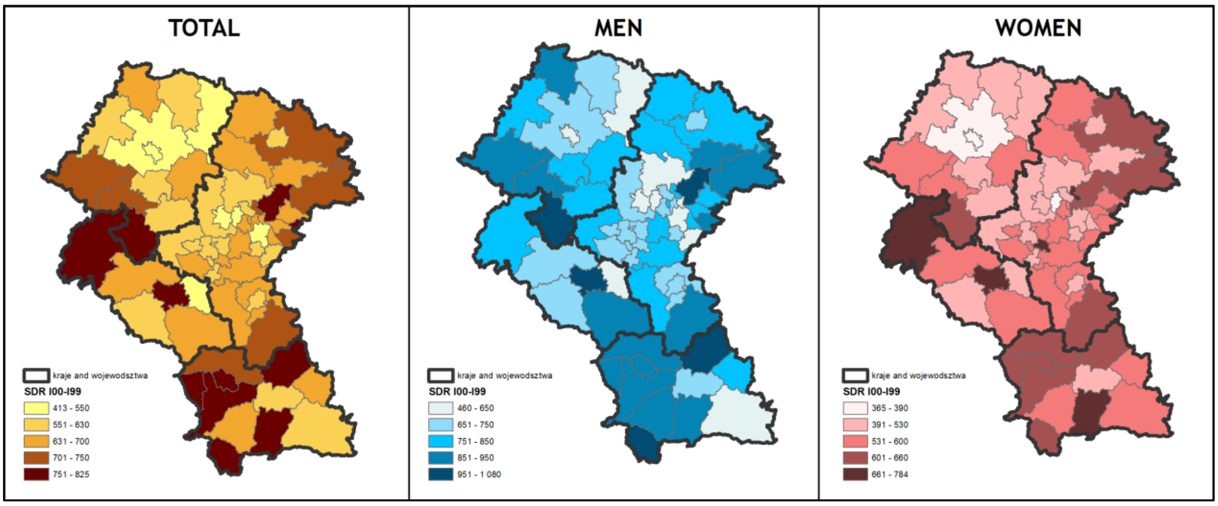
Figure 4.15: SDR for malignant lung cancer in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

Cardiovascular diseases dominate in SDR from this cause in the district Ostrava-city for both genders and Bruntál for women (Table 4.9) and Námestovo district for men; the absolute lowest SDR for diseases of the circulatory system is reported for both genders and for individual genders in Silesia LAU1 Zabrze. The graphical comparison (Figure 4.16) once again high values of SDR are placed in the Moravian-Silesian and Zilina regions for both sexes. In the evaluation of each gender, again, the heterogeneity of SDR values for cardiovascular disease is again evident.

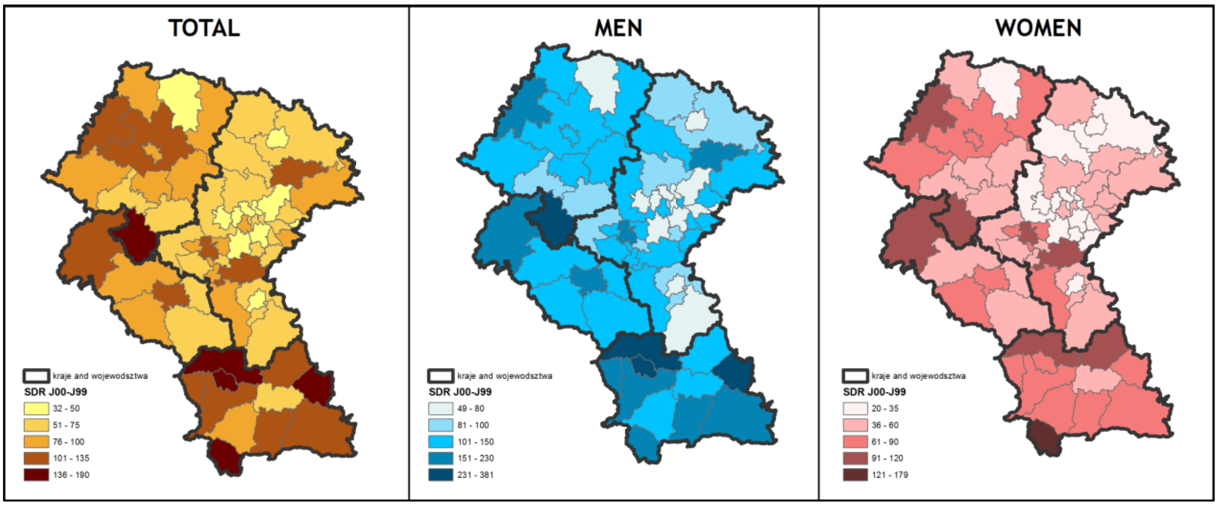
Figure 4.16: SDR for cardiovascular disease in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

Absolutely highest values of SDR for respiratory diseases (Table 4.9) are achieved in Slovak LAU1 for both genders, men and women in particular, lowest in the Silesian regions of Poland. For the respiratory system, most people of both genders and women in Turčianske Teplice and men in Kysucké Nové Město, and the least in the Silesian regions of Piekary Slaskie (both genders and women) and Mikolowski Powiat (men), die from the areas being compared. The graphical comparison (Figure 4.17) shows high values of SDR for respiratory diseases, especially in Slovak regions and the Opole Voivodeship for both sexes and men, but for women, values are lower, especially in LAU1 in the Silesian Voivodeship.

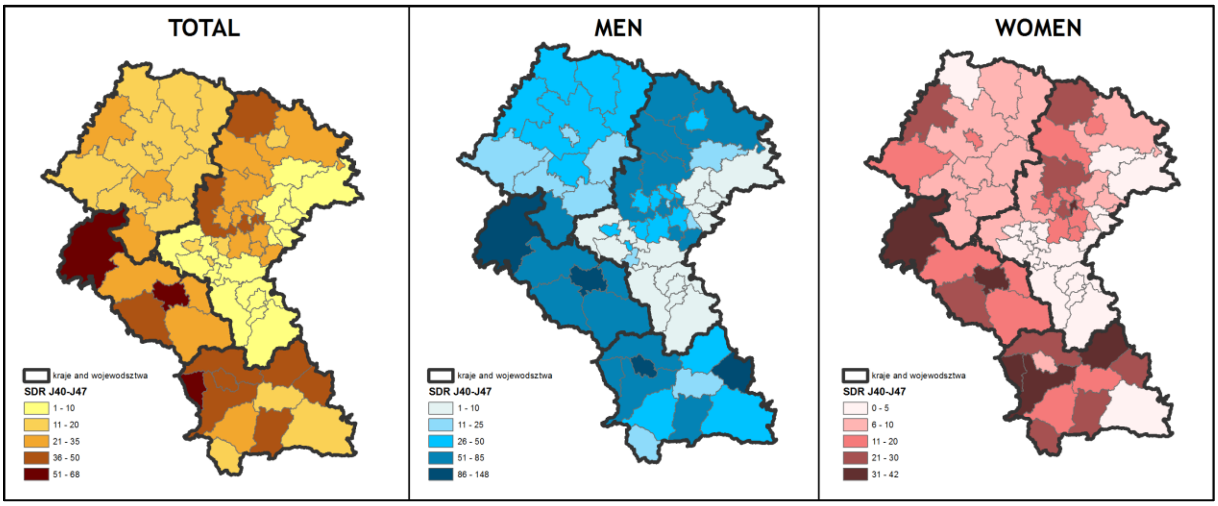
Figure 4.17: SDR for respiratory diseases in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

For the above reasons, SDRs for chronic lower respiratory diseases are given only informally.

Figure 4.18: SDR for chronic lower respiratory tract disease in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

The complete information on SDRs for each cause of the death by year, region, and gender can be found in the Annex in Table 9.1.

5 Territory Pollution, including Analysis of Impact on Mortality

Data description for analysis and modeling:

- A00_Y98 – total standardized mortality
- C00_C97 - standardized mortality due to malignant tumors
- C33_C34 - standardized mortality due to traumatic tumors of the trachea, bronchus and lungs
- I00_I99 - standardized mortality due to cardiovascular diseases
- J00_J99 – standardized mortality due to respiratory diseases
- J40_J47 - standardized mortality due to chronic lower respiratory tract disease
- PM10 – the amount of larger particulate matters in the air (see chapter 5.1)
- PM25 – the amount of smaller particulate matters in the air (see chapter 5.2)
- NOx - the amount of nitrogen oxides in the air (see chapter 5.3)
- BAP – the amount of benzo(a)pyrene in the air (see chapter 5.4)

5.1 PM10

In the air, aerosol is commonly present, a set of solid, liquid or mixed particles in the range of 1 nm to 100 μm. Aerosol is an important factor in precipitation, affecting the temperature balance of the Earth. PMX (Particulate Matter) aerosol clusters have been defined due to health effects on humans and are usually sized by PM10, PM2,5 and PM10.

PM10 particulate matter is dust less than 10 μm. Normally, atmospheres come from fires, erosion, volcanic activity, or from seawater, and anthropogenic sources are primarily fossil fuel combustion (power stations, incinerators, industry, transport, etc.). They are composed of a mixture of many kinds of substances (sulphates, soot, metals, inorganic salts, etc.).

Due to their small size, PM10 particles are able to penetrate the lower airways. On the surface of the dust particles themselves, heavy metals or organic substances may also be bound. Long-term exposure can lead to serious respiratory diseases (lung cancer, chronic bronchitis, chronic lung disease, etc.)[1].

The largest area of PM10 dust contamination is located in the southwestern part of the Silesian Voivodeship (Powiat Wodzisławski, powiat Rybnicki). In 2016, the highest average annual pollutant in the municipality of Radin (powiat Wodzisławski) was 97.04 μg/m3, with the maximum recommended by WHO (the World Health Organization) being 20 μg/m3. In 2015, this pollution in the same municipality decreased to 64.83 μg/m3, which is more than 3 times higher than the WHO limit. Significantly polluted is also the area of the central, southern and southeastern Opole Voivodeship and the north-eastern region of the Moravian-Silesian Region sharing the border with the Silesian Voivodeship. The smallest PM10 dust particles are polluted by the Zilina Region, where most of the territory under WHO was already in 2015. The map shows an improvement in pollution.

Table 5.1: Basic characteristics of PM10 pollution

	Mean	SD	Minimum	Maximum
2007	43,5	16,3	20,9	87,3
2011	42,7	18,7	17,6	107, 3
2015	33,2	12,0	14,0	75,0

Source: VŠB-TUO, 2018

[1] https://www.irz.cz/sites/default/files/latky/Poletavy_prach.pdf, https://arnika.org/poletavy-prach-pm10

The development of PM10 pollution (Table above) shows that it is gradually decreasing. Significant reductions occurred between 2011 and 2015.

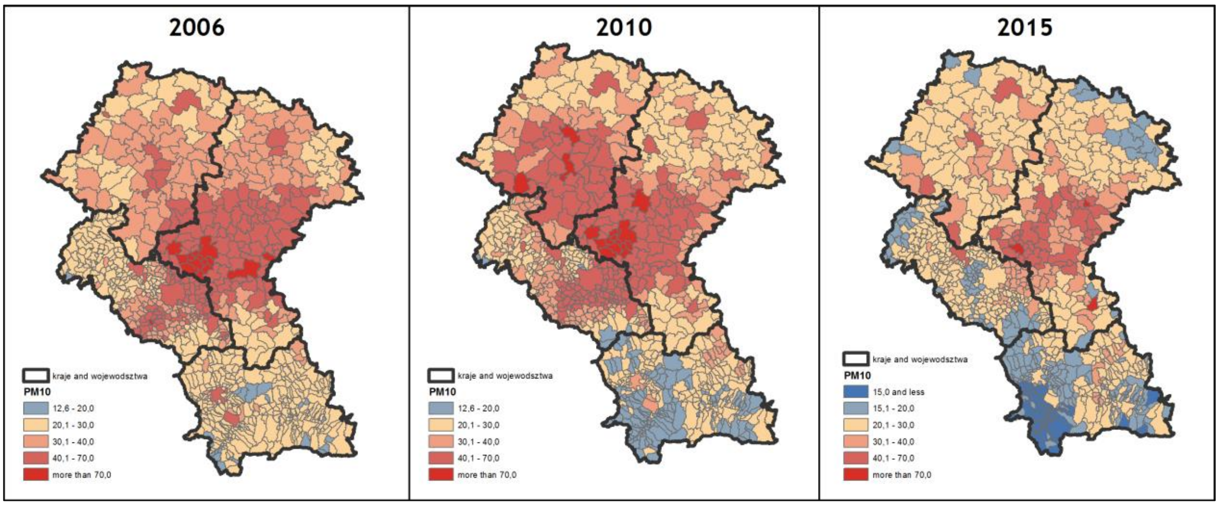
Table 5.2: Basic characteristics of PM10 pollution for individual years and regions

YEAR | REG	Mean	SD	Minimum	Maximum
2007 | MSK	35,1	8,51	23,6	50,3
2011 | MSK	37,0	7,89	28,0	51,5
2015 | MSK	24,8	4,77	21,4	34,9
2007 | OW	35	6,82	27,1	52,9
2011 | OW	44	15,12	25,3	77,5
2015 | OW	29	5,36	21,8	43,3
2007 | SW	53,7	13,79	29,5	87,3
2011 | SW	49,6	18,71	27,8	107,3
2015 | SW	40,1	10,82	21,3	75
2007 | ZSK	23,9	1,61	20,9	26,2
2011 | ZSK	21,8	3,16	17,6	28,8
2015 | ZSK	19,8	4,18	14	25,9

Source: VŠB-TUO, 2018

The table above shows the development of PM10 pollution in individual regions over the three observed years. The most affected region is the Silesian Voivodeship, followed by the Opole Voivodeship and the Moravian-Silesian region. The lowest PM10 load is in the Zilina region. While the concentration continuously declines between the years 2007 and 2015 in the Silesian Region and the Silesian Voivods, the Moravian-Silesian region and the Opole Voivods recorded a slight increase in 2011, but in the final year 2015, in both regions, the PM10 concentration dropped below the initial values in 2007.

Figure 5.1: PM_{10} particulate matter pollution development



Source: VŠB-TUO, 2018, own processing. Note: In blue color are shown the values below the WHO (World Health Organization) limit; values in µg/m3.

5.2 PM2,5

PM2.5 (Particulate Matter) particles are dust particles with a diameter up to 2.5 µm. Compared with PM10 particles, PM2,5 is a little more dangerous because smaller particles more easily penetrate the body and can bind dangerous substances such as heavy metals or organic matter. Also, the principle is that the smaller the particle diameter, the longer it will remain in the air[2].

[2] https://arnika.org/poletavy-prach-

The most polluted PM2.5 is the Central and South-Western regions of the Silesian Voivodeship and the northeast of the Moravian-Silesian border region. In 2006 and 2010, no municipalities had the WHO limit of 10 µg/m3, in 2015 it was already met by 32 municipalities in the Zilina Region. On the maps, however, an increase in air quality is visible.

Table 5.3: Basic characteristics of PM2,5

	Mean	SD	Minimum	Maximum
2007	37,9	20,7	15,9	86,3
2011	32,4	15,1	13,3	85,9
2015	28,2	11,5	10,5	69,3

Source: VŠB-TUO, 2018

The development of PM2.5 pollution (Table above) shows that it is gradually decreasing. The decrease between 2007 and 2011 is roughly the same as between 2011 and 2015.

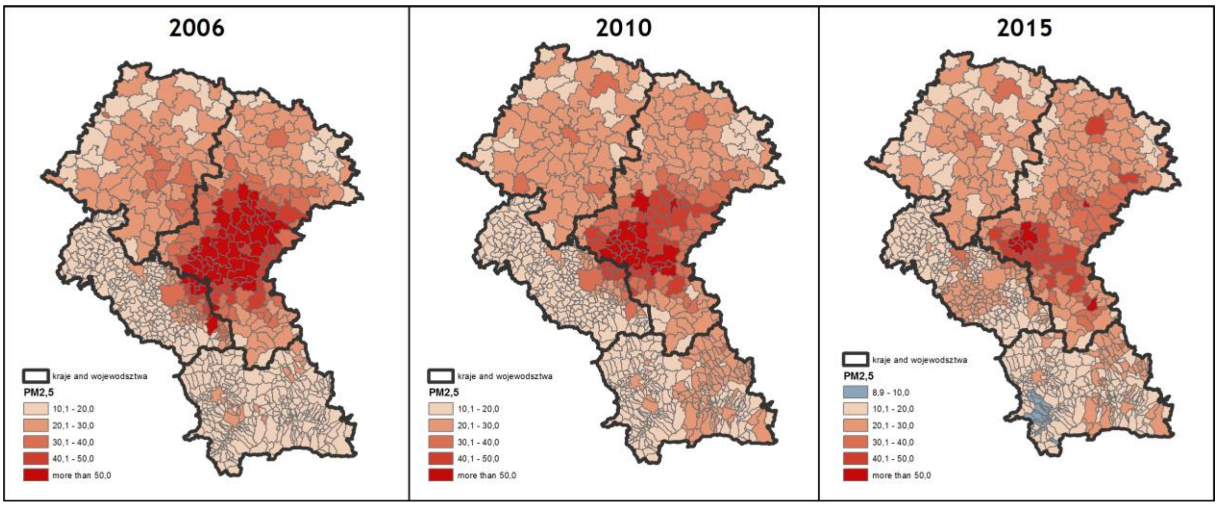
Table 5.4: Basic characteristics of PM2,5 pollution for individual years and regions

YEAR | REG	Mean	SD	Minimum	Maximum
2007 | MSK	23,8	10,64	16,5	46
2011 | MSK	20,6	8,58	14	38,7
2015 | MSK	19,4	3,83	13,1	24,8
2007 | OW	24	4,31	18,6	32,8
2011 | OW	23,7	3,91	18,8	34,8
2015 | OW	22,6	3,68	17,9	32,8
2007 | SW	51,2	18,39	20,8	86,3
2011 | SW	41,6	13,88	21,6	85,9
2015 | SW	35,3	10,21	22,1	69,3
2007 | ZSK	17,4	0,96	15,9	19,5
2011 | ZSK	18,4	3,78	13,3	24,4
2015 | ZSK	16	4,35	10,5	24,1

Source: VŠB-TUO, 2018

The table above shows the development of PM2.5 pollution in individual regions over the three observed years. The most affected region is the Silesian Voivodeship, followed by the Opole Voivodeship and the Moravian-Silesian region. The smallest amount of PM2,5 is in the Zilina region. While in the Moravian-Silesian region and in both Voivodes the PM2.5 concentrations gradually declined between 2007 and 2015, there was a slight increase in the Zilina Region in 2011, but in the end of 2015 the PM2.5 concentration dropped below the initial values from 2007.

Figure 5.2: $PM_{2,5}$ particulate matter pollution development



Source: VŠB-TUO, 2018, own processing. Note: In blue color are shown the values below the WHO (World Health Organization) limit; values in µg/m3.

5.3 Nitrous Oxide NO_2

The most common NOx oxides include nitrogen dioxide (NO2) and nitric oxide (NO).

Most nitrogen oxides come into the air due to transport, the chemical industry, and combustion processes. NO2, along with sulfur oxides, is part of acid rain. Oxygen and volatile organic compounds also help to form ground-level ozone and so-called photochemical smog.

At low concentrations, NO2 causes irritation of the eyes and upper respiratory tract, then passes into the blood, where it is subsequently converted into nitrates and nitrites. Dangerous are even very low concentrations if they influence a human for a longer period[3].

The most polluted by nitrogen oxides are the middle and east of the Silesian Voivodeship (Katowice 54.68 µg/m3, Czeladź 57.00 µg/m3), the least polluted areas are the north and west of the Opole Voivodeship, the West of the Moravian-Silesian region and almost the entire Zilina region. Municipalities exceeding the WHO limit of 40 µg/m3 are 20 in total and all are located in the Silesian Voivodeship. A progressive improvement in pollution is evident.

Table 5.5: Basic characteristics of NOx pollution

	Mean	SD	Minimum	Maximum
2007	23,6	15,5	7, 1	65,0
2011	25,8	17,1	8,0	60,3
2015	22,6	14,6	6,1	54,7

Source: VŠB-TUO, 2018

The NOx pollution trend (Table above) shows that there was an increase between 2007 and 2011, and then the original average content of this substance was reduced (from 23.6 to 22.6 µg/m3) in 2015.

Table 5.6: Basic characteristics of NOx pollution for individual years and regions

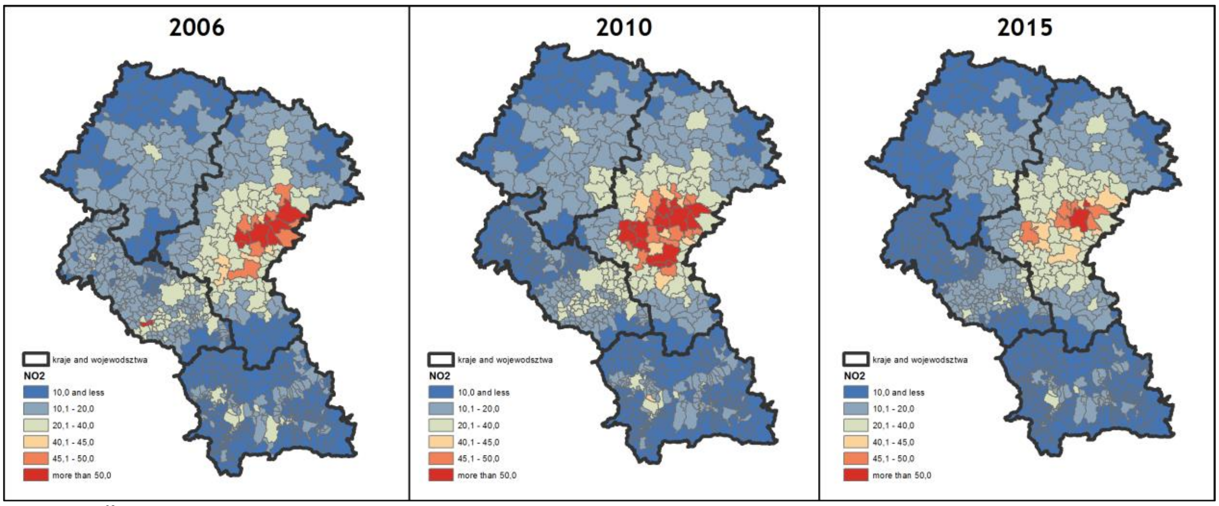
YEAR | REG	Mean	SD	Minimum	Maximum
2007 | MSK	15,4	4,38	11,0	22,0
2011 | MSK	14,9	5,48	8,7	24,4
2015 | MSK	11,8	3,34	7,0	17,3
2007 | OW	12,4	5,80	8,0	30,2
2011 | OW	12,7	4,19	8,3	22,3
2015 | OW	12,0	4,83	7,6	23,7
2007 | SW	33,0	14,64	9,0	65,0
2011 | SW	36,9	15,24	10,3	60,3
2015 | SW	32,3	12,53	9,4	54,7
2007 | ZSK	9,4	1,82	7,1	13,3
2011 | ZSK	9,8	1,51	8,0	12,3
2015 | ZSK	8,3	1,80	6,1	11,9

Source: VŠB-TUO, 2018

The table above shows the development of NOx pollution in individual regions over the three observed years. The most affected region is the Silesian Voivodeship, followed by the Moravian-Silesian region and the Opole Voivodeship. The smallest NOx pollution is in the Zilina region. While the NOx concentration gradually decreases in the Moravian-Silesian region between 2007 and 2015, there was a slight increase in the remaining three regions in 2011, but in the final year of 2015, NOx concentrations dropped below the initial 2007 values.

[3] https://arnika.org/oxidy-dusiku, https://www.irz.cz/sites/default/files/latky/Oxidy_dusiku.pdf

Figure 5.3: NO_X pollution development



Source: VŠB-TUO, 2018, own processing. Note: In blue color are shown the values below the WHO (World Health Organization) limit; values in µg/m3.

5.4 Benzo(a) Pyrene

Benzo(a) pyrene (chemical formula C20H12, also referred to as BAP) is an aromatic organic substance released into the atmosphere by combustion of organic materials. Naturally occurs in fires and volcanic activities, anthropogenically in many industrial processes, especially in coal-fired power plants. It is also part of exhaust gases and tobacco smoke.

The body is most often given inhalation, where it is metabolized relatively quickly. Some of the benzo(a) pyrene metabolites are considered to be carcinogenic. Chronic exposure may cause damage to the respiratory tract and the gastrointestinal tract, the immune system, red blood cells, reduced reproductive performance may be also impaired. It is toxic and mutagenic[4].

The benzo(a) pyrene pollution values were between 3,06 and 18,19 µg/m3 in 2015. Municipalities – 15 in total with values above 10 µg/m3 are concentrated, as shown on the map below, in the southern and southeast areas of the Opole Voivodeship and in the south-west of the Silesian Voivodeship. Elevated pollution values are also outside the province in the north of the Zilina region and in the southern part of the Moravian-Silesian region. Below the health limit of 1 µg/m3, are the values in the northwest of the Moravian-Silesian region, the northeast of the Silesian Voivodeship and the selective municipalities of the southern part of the Zilina Region.

Table 5.7: Basic characteristics of BAP pollution

	Mean	SD	Minimum	Maximum
2007	8,5	6,4	0,8	26,5
2011	6,9	4,7	1,3	24,4
2015	4,7	2,8	1,1	13,8

Source: VŠB-TUO, 2018

The BAP contamination trend (Table 5.7) shows that it is gradually decreasing. The reduction is smooth, with an average reduction of 1.6 between 2007 and 2011, and by 2015 BAP has been further reduced on average by 2.2 µg/m3.

4 https://arnika.org/benzoapyren, https://www.irz.cz/node/86

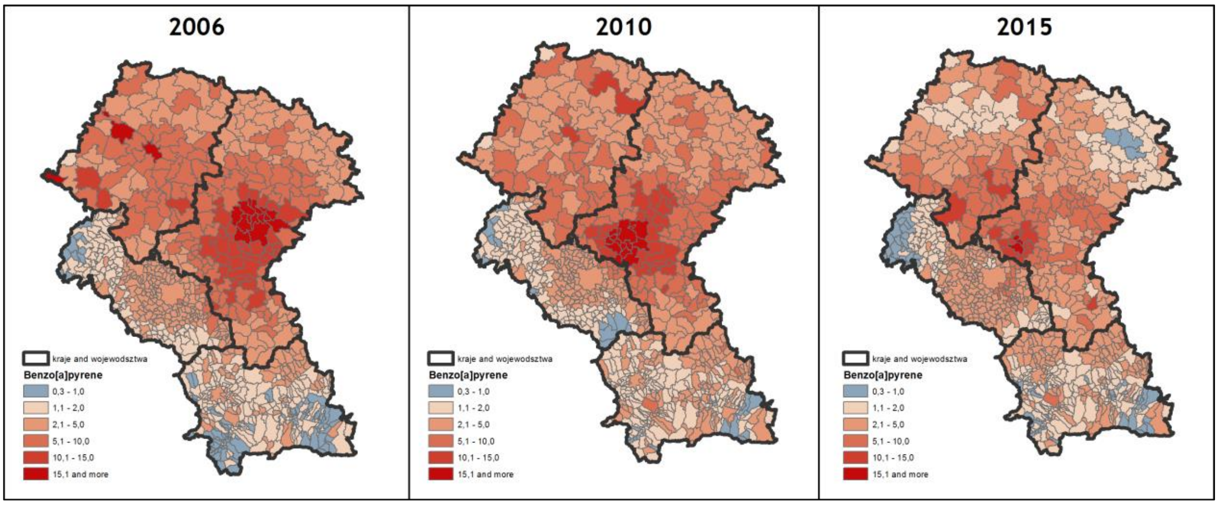
Table 5.8: Basic characteristics of BAP pollution for individual years and regions

YEAR | REG	Mean	SD	Minimum	Maximum
2007 | MSK	2,8	0,9	1,4	4,1
2011 | MSK	2,7	1,29	1,4	5,3
2015 | MSK	2,9	1,07	1,3	4,5
2007 | OW	7,2	3,88	3,4	18,2
2011 | OW	5,6	1,68	3,4	10,5
2015 | OW	4,7	2,05	2,3	7,9
2007 | SW	11,9	5,96	3,5	26,5
2011 | SW	9,5	4,6	3,6	24,4
2015 | SW	5,8	2,9	1,3	13,8
2007 | ZSK	1,5	0,55	0,8	3
2011 | ZSK	2,1	0,72	1,3	3,8
2015 | ZSK	2	0,64	1,1	3,2

Source: VŠB-TUO, 2018

The table above shows the development of BAP pollution in individual regions over the three observed years. The most affected region is the Silesian Voivodeship, followed by the Opole Voivodeship and the Moravian-Silesian region. The lowest BAP pollution is in the Zilina Region. While Poland's BAP concentration gradually declined between 2007 and 2015, the BAP concentration in the Moravian-Silesian region decreased slightly in 2011 to 2015, and in the Zilina region, after a larger increase in 2011, there was a slight decrease in 2015. In both areas, however, the BAP concentration is higher in the final year of 2015 than in 2007.

Figure 5.4: BAP pollution development



Source: VŠB-TUO, 2018, own processing. Note: In blue color are shown the values below the WHO (World Health Organization) limit; values in µg/m3.[3].

5.5 Analysis of Differences in Air Pollution among Areas

5.5.1 Air Quality Index According to SZU Methodology

The Air Quality Index (IKO) is calculated on the basis of four measured air pollution factors (PM10, PM2,5, BAP and NOx). The relationship for the calculation of IKO is:

$$IKO = \frac{\sum_{n=1}^{N} \frac{k_n}{K_n}}{N},$$

where N denotes the number of pollutants (4), kn is the concentration value of *n-th* substance for the given region and Kn is the *n-th* limit. The limits for individual substances determined by WHO are: K_{PM10} = 20 µg/m3, $K_{PM2,5}$ = 10 µ/m3, K_{NOx} = 40 µg/m3 and K_{BAP} = 1 µg/m3.

IKO can reach these values:

- ✓ **From 0 to 1:** the air pollution in the area according to the evaluated pollutants is below the WTO limit
- ✗ **1,01 and more**: the air pollution in the area according to the evaluated pollutants exceeds the WTO limit

IKO, is verbally ranked in these categories:

1. **Clean air**
   - values from **0 to 1**
2. **Compliant air**
   - **1,01 to 2**
3. **Slightly polluted air**
   - **2,01 to 3**
4. **Polluted air**
   - **3,01 to 4**
5. **Heavily polluted air**
   - **4,01 to 5**
6. **Harmful air**
   - **5,01 to 6**

Table 5.9: Basic characteristics of IKO for individual years observed

YEAR	Mean	SD	Minimum	Maximum
2007	3,8	2,31	0,91	9,78
2011	3,2↓	1,84	0,93↑	9,95↑
2015	2,4↓	1,11	0,76↓	6,20↓

Source: VŠB-TUO, 2018, own computations. Note: In blue color are shown the values below the WHO (World Health Organization) limit; values in µg/m3.[3].

The overall air quality index between 2007 and 2015 is declining, which means air quality is improving. Similarly, the standard deviation (SD) is reduced, thus reducing the differences in air quality between regions (IKO of each area is coming closer to each other).

Table 5.10: Basci characteristics of IKO for each region and individual years

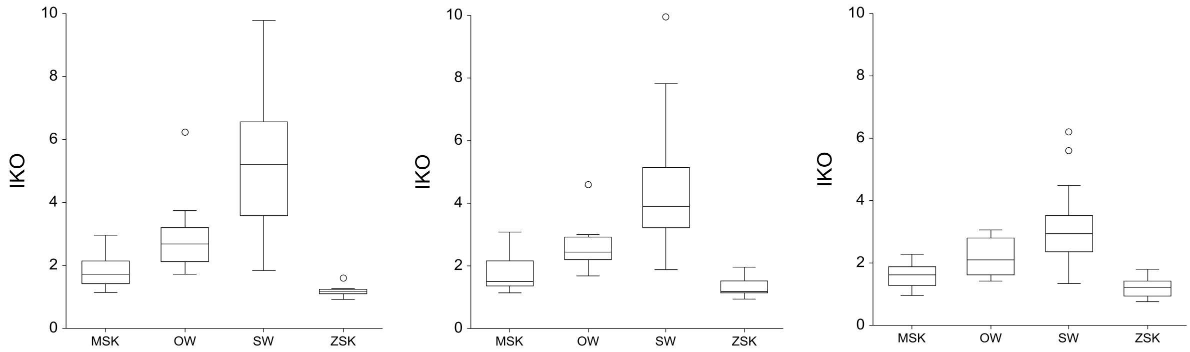
REG	YEAR	Mean	SD	Minimum	Maximum
MSK	**2007**	1,8	0,62	1,1	3,0
	2011	1,7	0,69	1,1	3,1
	2015	1,6	0,44	1,0	2,3
OW	**2007**	2,9	1,20	1,7	6,2
	2011	2,6	0,72	1,7	4,6
	2015	2,2	0,60	1,4	3,1
SW	**2007**	5,1	2,07	1,8	9,8
	2011	4,3	1,77	1,9	9,9
	2015	3,0	1,05	1,3	6,2
ZSK	**2007**	1,2	0,18	0,9	1,6
	2011	1,3	0,31	0,9	2,0
	2015	1,2	0,31	0,8	1,8

Source: VŠB-TUO, 2018

From the development of the average values of the IKO index for individual regions it can be stated that the least polluted air is in the Zilina Region (1,2), followed by the Moravian-Silesian region (1,6). For Polish regions, IKO values are higher, Opole Voivodes having a better air quality (2.2) than the

Silesian Voivodeship (3), which recorded the largest decline in the index (-2.1) in the period under review and thus the largest positive change in air quality. The increase in pollution occurred in the years under review only in the Zilina region, between 2007 and 2011, and in 2015 the value of the index returned to the level of 2007. In the other regions, IKO is continuously decreasing, thus, the air quality is improving.

Figure 5.5: IKO index development in the years 2007, 2011 and 2015



Source: VŠB-TUO, 2018, own processing

For the clarity sake, a box graph is made for the IKO differences between the four regions for each year. In the first year of measurement (2007) the differences between the regions are the most dramatic, with the highest values of IKO reached by the Silesian Voivodeship, where the air quality is the lowest. Moreover, some areas of the Silesian Voivodes have similar pollution as the Opole Voivodeship, while others are highly polluted (can be seen from the height of the box and lines).

In 2011, the IKO values for each area of the Silesian Voivodeship decreased and there was also a small increase in IKO in the Žilina Region. The overall level of air pollution between the regions has been maintained. In 2015, IKO is decreasing in the monitored regions, as well as declining between regions in early 2007. However, the distribution of regions by the level of pollution remains the same as in previous years.

In addition, the Friedman test (two-way variance analysis) is applied to detect significant differences in IKO between regions in three years. The zero hypothesis, meaning that there is no significant difference between regions, is rejected because the P-value is not equal to zero (P-value = 0.029). With Tukey-Kramer's multiple comparison, it was further found that there was a significant difference between the values of the IKO Index of the Silesian Voivodeship and the other regions, as well as between the values of the Zilina Region and the Opole Voivodeship (for more detail see the annex).

Of the measured air quality indexes, six categories of pollution are also derived from the SO so that the IKO increases one by one from zero to six. Therefore, the air is gradually: favorable, comfortable, slightly soiled, polluted, heavily polluted, and all IKO values from six above are marked as harmful air.

Table 5.11: Air quality category index in year 2007

Region	Clean air	Compliant air	Slightly polluted air	Polluted air	Heavily polluted air	Harmful air
MSK	0	5	1	0	0	0
OW	0	2	5	4	0	1
SW	0	1	6	4	6	19
ZSK	2	9	0	0	0	0
Total	*2*	*17*	*12*	*8*	*6*	*20*

Source: VŠB-TUO, 2018, own processing

Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

In 2007, all regions of the Žilina Region are in a favorable or comfortable atmosphere. Five of the six regions of the Moravian-Silesian region have an adequate atmosphere and one slightly polluted. The worst situation is in the Silesian Voivodeship, where 19 out of 36 areas (i.e. more than half) are in the worst - degraded atmosphere.

Table 5.12: Air quality category index in year 2011

Region	Clean air	Compliant air	Slightly polluted air	Polluted air	Heavily polluted air	Harmful air
MSK	0	5	0	1	0	0
OW	0	1	10	0	1	0
SW	0	2	5	13	6	10
ZSK	1	10	0	0	0	0
Total	*1*	*18*	*15*	*14*	*7*	*10*

Source: VŠB-TUO, 2018, own processing

Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

In 2011 all areas of the Zilina region are in favorable or satisfying air conditions, since 2007 there has been a deterioration of the air in one area. Five of the six regions of the Moravian-Silesian region have an adequate atmosphere and one polluted (it worsen). The worst situation is in the Silesian Voivodeship, where 10 of the 36 areas are in the worst quality, however there have been significant improvements compared to year 2007.

Table 5.13: Air quality category index in year 2015

Region	Clean air	Compliant air	Slightly polluted air	Polluted air	Heavily polluted air	Harmful air
MSK	1	4	1	0	0	0
OW	0	5	6	1	0	0
SW	0	5	15	12	2	2
ZSK	4	7	0	0	0	0
Total	*5*	*21*	*22*	*13*	*2*	*2*

Source: VŠB-TUO, 2018, own processing

Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

In 2015, all areas of the Žilina Region have favorable or satisfying atmosphere, due to both previous measurements, have improved the situation. There was also an improvement in the Moravian-Silesian region, where the least polluted air was measured in one area and the worst area is polluted only slightly. The worst situation is in the Silesian Voivodeship, where of course from the original 19 areas of the 36 in year 2007 have the worst air - harmful state is now only two areas (Rybnik and Wodzisławski).

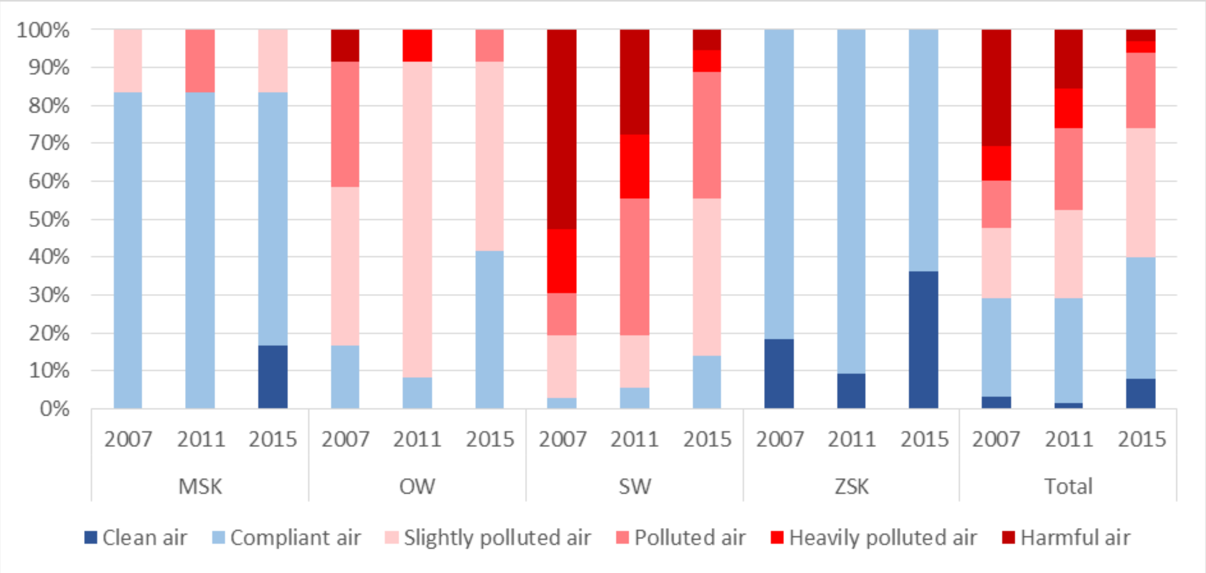
The graph and table of units of territorial units relative to the pollution rate in the evaluated years (below) show the development of the IKO index for the evaluated territories. The Silesian Voivodship is the most polluted area in the chart, with 52.8% of LAU 1 territorial units in 2007 falling into the sixth category of “Harmful air”. In 2015, only 5,6% of areas in Silesian Voivodeship belongs to this category, and the category “Slightly polluted air” (41,7%) and “Polluted air” (33,3%) are the most represented categories.

Much better is the air in the Opole Voivodship, where the territorial units with “Harmful air” (originally 8.3%) and the Territorial Units with "Heavily polluted air"; 8.3%). In 2015, the LAU 1 territorial units with “Slightly Polluted Air“ (50.0%) and “Compliant Air” (41.7%) were the most represented.

While the Moravian-Silesian region recorded a mild air deterioration in 2011 (16.7%), in 2015, this territorial unit returned to the original IKO category and added LAU 1 to "Clean Air" (16.7%). Most of the territorial units of the Moravian-Silesian region have a "compliant air" (66.7%).

According to IKO, the Žilina Region is best rated. In all three years, its territorial units are only in "Clean Air" and "Compliant Air" categories at 36.4% and 63.6% in 2015. The figures are further illustrated on the map.

Figure 5.6: The share of LAU-1 territorial units in relation to the level of pollution in individual regions in 2007, 2011 and 2015



Source: VŠB-TUO, 2018, own processing

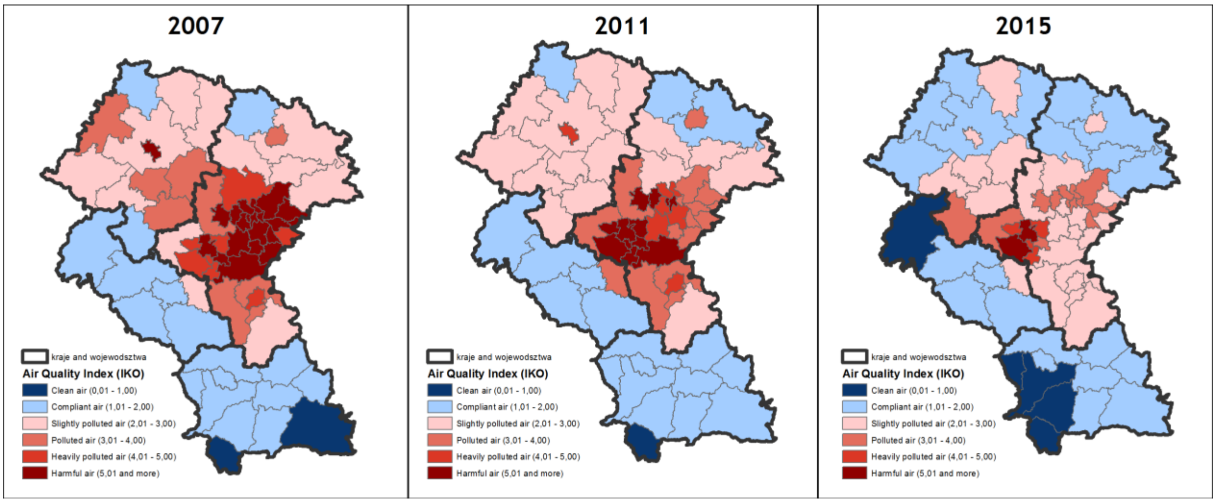
Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

Table 5.14: The share of LAU-1 territorial units in relation to the level of pollution in individual regions in 2007, 2011 and 2015

Region	Year	Clean air	Compliant air	Slightly polluted air	Polluted air	Heavily polluted air	Harmful air
MSK	2007	0,0%	83,3%	16,7%	0,0%	0,0%	0,0%
	2011	0,0%	83,3%	0,0%	16,7%	0,0%	0,0%
	2015	16,7%	66,7%	16,7%	0,0%	0,0%	0,0%
OW	2007	0,0%	16,7%	41,7%	33,3%	0,0%	8,3%
	2011	0,0%	8,3%	83,3%	0,0%	8,3%	0,0%
	2015	0,0%	41,7%	50,0%	8,3%	0,0%	0,0%
SW	2007	0,0%	2,8%	16,7%	11,1%	16,7%	52,8%
	2011	0,0%	5,6%	13,9%	36,1%	16,7%	27,8%
	2015	0,0%	13,9%	41,7%	33,3%	5,6%	5,6%
ZSK	2007	18,2%	81,8%	0,0%	0,0%	0,0%	0,0%
	2011	9,1%	90,9%	0,0%	0,0%	0,0%	0,0%
	2015	36,4%	63,6%	0,0%	0,0%	0,0%	0,0%
Total	2007	3,1%	26,2%	18,5%	12,3%	9,2%	30,8%
	2011	1,5%	27,7%	23,1%	21,5%	10,8%	15,4%
	2015	7,7%	32,3%	33,8%	20,0%	3,1%	3,1%

Source: VŠB-TUO, 2018, own processing Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

Figure 5.7: Air quality index in LAU 1 territorial units



Source: VŠB-TUO, 2018, own processing. Note: 1. Clean air, 2. Compliant air, 3. Slightly polluted air, 4. Polluted air, 5. Heavily polluted air, 6. Harmful air*

CORRELATION BETWEEN IKO AND SDR - all years and regions

The Pearson correlation coefficient is calculated for the dependency determination (SDR) and Air Quality Index (IKO). The coefficient close to 0 means that IKO does not have a significant effect on the mortality rate in the area. Conversely, the coefficients close to 1 show the dependence of SDR on IKO. For a simple decision whether the coefficient is close to or far from zero (whether the observed dependence is significant), the zero hypothesis "coefficient is equal to zero" is tested for each coefficient (no dependency is between variables). In the case of a rejection, the coefficient is a "*" sign.

In Table 5.11, the correlation for the total set (i.e. all years) for the whole TRITIA region are shown. It can be seen that only total mortality is not dependent on IKO. The coefficients between IKO and cancer mortality (in general, and lung tumors) are positive, and these forms of mortality also increase with increasing air pollution.

Table 5.15: Correlation coefficients of dependence between SDR and IKO in the TRITIA region

YEAR	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
All	*N*	*0,208**	*0,397**	*N*	*N*	*N*
2007	*N*	0,376*	0,431*	*N*	*N*	*N*
2011	*N*	*N*	0,254*	*N*	*N*	*N*
2015	*N*	*N*	0,380*	*N*	*N*	*N*

Source: ÚZIS, ČSÚ, SÚSR, VŠB-TUO, 2018, own processing

Note: denotes the correlation coefficient between the two variables in which a statistically significant dependence was found, N are statistically insignificant values or artificial statistical artifacts, e.g. decreasing mortality with increasing air pollution.*

5.5.2 Modeling the Dependence of Mortality Types on Air Pollution and Population's Socio-economic Factors

In chapter 6 the dependence of individual mortality types (A00-Y98, ... J40-J47) on air pollution and socio-economic factors of the population is modeled. In the following, the differences between air pollution between the four regions are identified by applying a two-way variance analysis represented by the Friedman test. The zero hypothesis of the test is determined by a significant difference between the four regions in the given pollutant (i.e. PM10, PM2,5, BAP and NOx). If this hypothesis is rejected, at least one region differs from other regions in terms of pollution.

Factor PM10:

Table 5.16: Region's statistics for PM10 factor

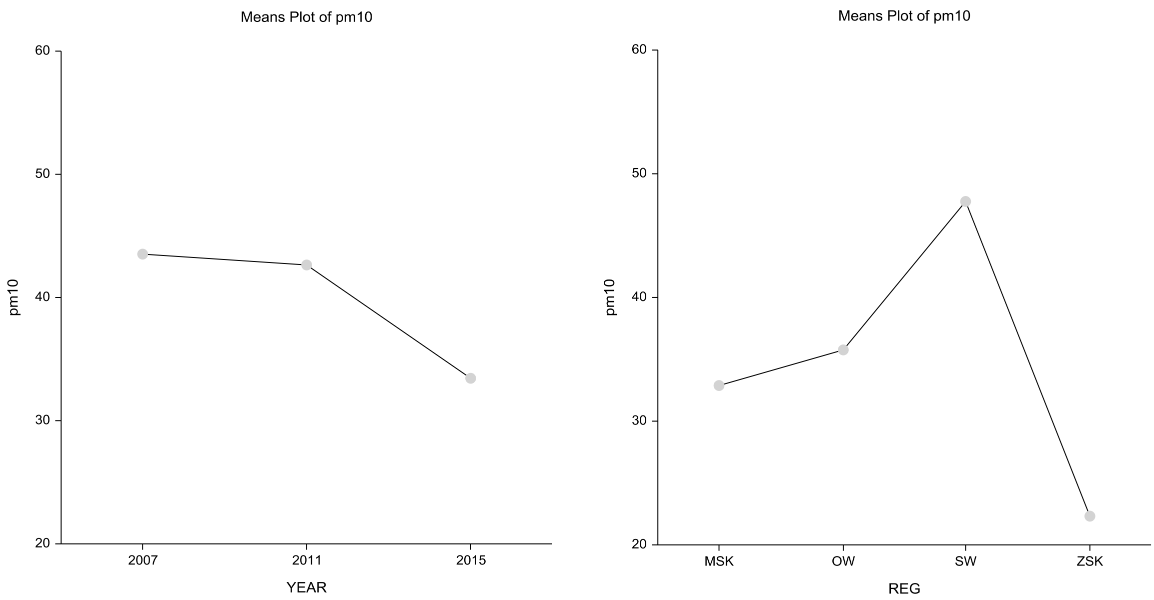
REG	Median	Rank
ZSK	21,753	1
MSK	35,122	2
OW	35,017	3
SW	49,560	4

Source: VŠB-TUO, 2018, own processing

Note: P-value=0,042

The zero hypothesis of the Friedman test was rejected, therefore air quality in terms of larger particulate matter is a significantly different among the 4 regions. From the average ranking of the regions for all three observed years it can be stated that the lowest pollution with larger airborne particles is in the Žilina Region, on the contrary, the most polluted air in the Silesian Voivodeship. The Moravian-Silesian region has roughly the same air quality as the Opole Voivodeship. Differences in average pollution between the three years can be seen in decreasing trends. The differences between the four regions are evident.

Figure 5.8: Differences between years and between regions graphs (PM10 factor)



Source: VŠB-TUO, 2018, own processing

From the multiple comparison of the content of larger particulate matter among the four regions, it can be said that the Silesian Voivodship differs from other regions, and the Opole Voivodeship differs from the Zilina region.

Factor PM2,5:

Table 5.17: Region's statistics for PM2,5 factor

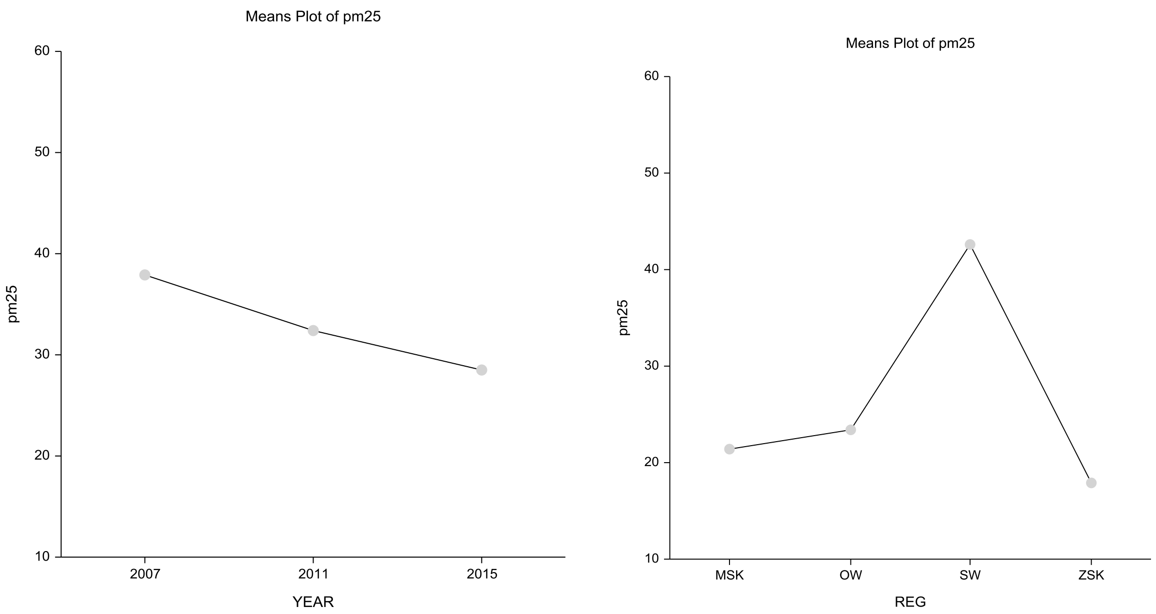
REG	Median	Rank
ZSK	17,445	1
MSK	20,601	2
OW	23,667	3
SW	41,600	4

Source: VŠB-TUO, 2018, own processing

Note: P-value=0,029

The zero hypothesis of the Friedman test was rejected, therefore air quality in terms of smaller airborne particles is a significantly different between 4 regions. From the average ranking of the regions for all three observed years it can be stated that the lowest pollutant content of the smaller airborne particles is in the Zilina Region, on the contrary, the most polluted air in the Silesian Voivodeship. The Moravian-Silesian region has only slightly better air quality than the Opole Voivodeship. Differences in average pollution between the three observed years can be seen in declining tendencies. There are also significant differences between the four regions.

Figure 5.9: Differences between years and between regions graphs (PM2,5 factor)



Source: VŠB-TUO, 2018, own processing

From the multiple comparison of the content of smaller airborne particles between 4 regions, it can be said that only the Silesian voivods differ from other regions.

Factor NOx:

Table 5.18: Region's statistics for NOx factor

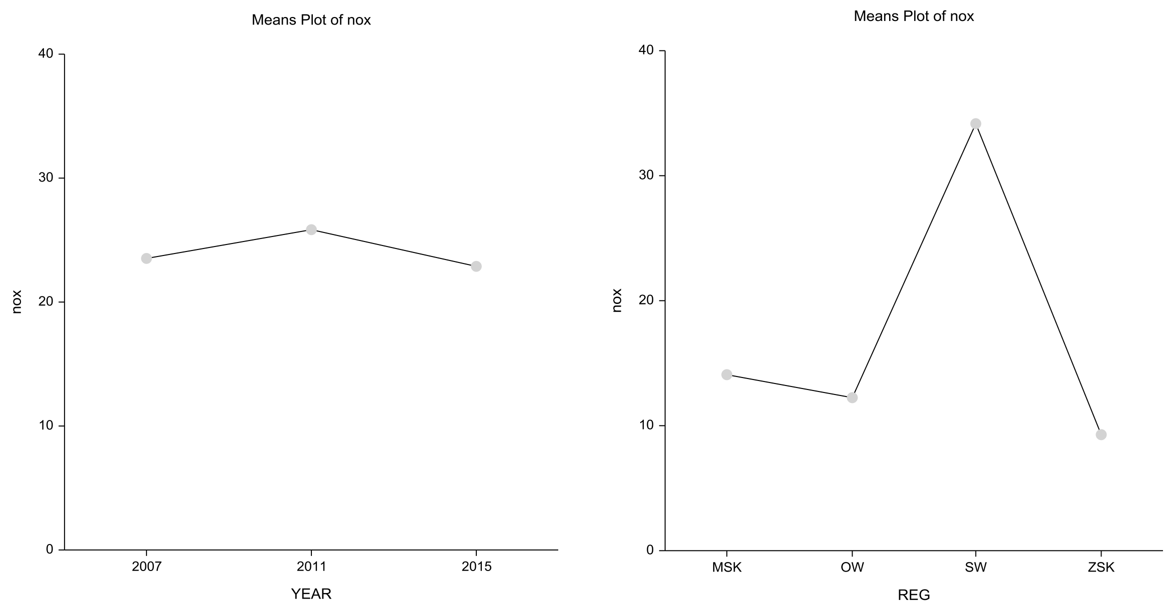
REG	Median	Rank
ZSK	9,363	1
OW	12,422	2
MSK	14,865	3
SW	32,953	4

Source: VŠB-TUO, 2018, own processing

Note: P-value=0,029

The zero hypothesis of the Friedman test was rejected, therefore air quality in terms of air NOx content is a significantly different between the 4 regions. From the average ranking of the regions for all three observed years it can be stated that the lowest NOx pollution is in the Zilina region, on the contrary the most polluted air in the Silesian Voivodeship. The Moravian-Silesian region has only slightly lower air quality than the Opole Voivodeship. From the graphs of the average pollution difference between the three years, it can be seen that after the 2011 increase, there is a decreasing trend. There are also significant differences between the four regions.

Figure 5.10: Differences between years and between regions graphs (NOx factor)



Source: VŠB-TUO, 2018, own processing

From the multiple comparison of NOx content between 4 regions, it can be said that the Silesian Voivods differs from other regions, and the Moravian-Silesian region differs from the Zilina region.

Factor BAP:

Table 5.19: Region's statistics for BAP factor

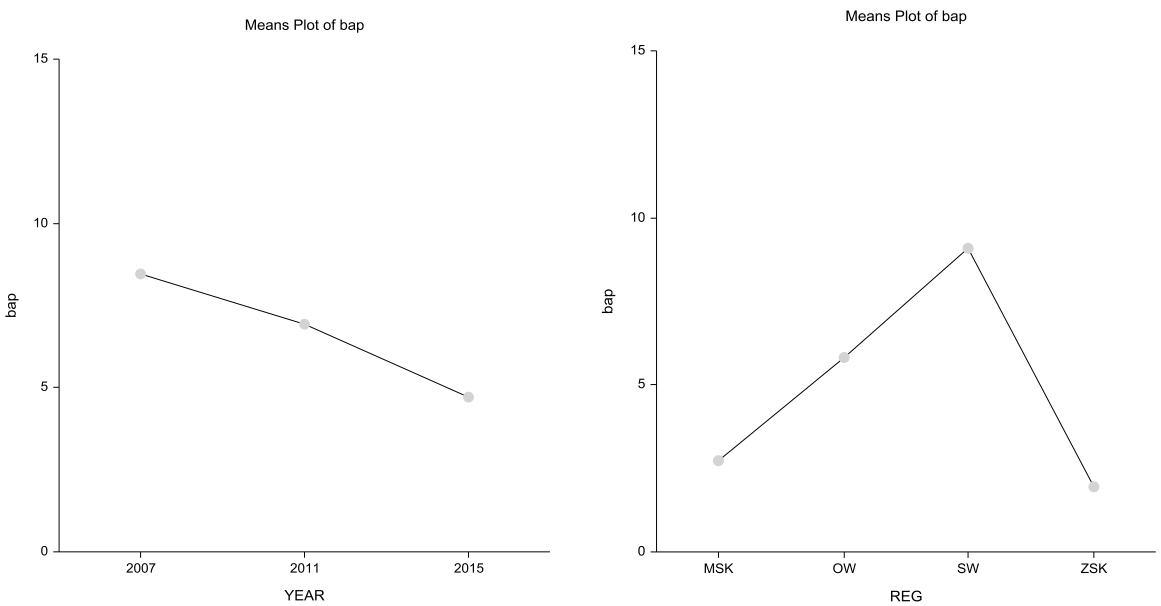
REG	Median	Rank
ZSK	1,996	1
MSK	2,752	2
OW	5,606	3
SW	9,546	4

Source: VŠB-TUO, 2018, own processing

Note: P-value=0,029

The zero hypothesis of the Friedman test was rejected, therefore, the air quality including the BAP pollution is significantly different between the four regions. From the average ranking of the regions for all three observed years it can be stated that the lowest contamination of BAP is in the Žilina Region, the Moravian-Silesian region has only slightly lower air quality. On the contrary, the most polluted atmosphere is in the Silesian Voivodeship. Differences in average pollution between three years can be seen in declining tendencies. There are also significant differences between the four regions.

Figure 5.11: Differences between years and between regions graphs (BAP factor)



Source: VŠB-TUO, 2018, own processing

From the multiple comparison of the BAP content between the four regions, it can be said that only the Silesian Voivods differs from other regions, small differences are between the Moravian-Silesian and the Zilina Regions.

5.6 Summary including Interpretation

The recommended annual human exposure limit (WHO) for PMIs is 20 µg/m3 for PM_{10}, 10 µg/m3 for PM_2, 40 µg/m3 and for benzo(a) pyrene 1 µg/m3. When comparing these limits with the average values of the whole area of the three evaluated years, the values of all substances except nitrogen dioxide are above the limit, but this limit is significantly exceeded in specific areas close to the sources of pollution. However, for all substances, a gradual reduction of pollution can be observed.

Air pollution has significantly changed over the three years between the four regions. It was found that the lowest pollution is in the Zilina region, while the most polluted air is in the Silesian

Voivodeship. The Moravian-Silesian region is second in terms of airborne particles and benzo(a) pyrene, and third after the Opole Voivodeship from the point of view of nitrogen oxides.

6 The Overall Model of Relations

List of evaluated diagnosis:

- A00_Y98 – total standardized mortality
- C00_C97 - standardized mortality due to malignant tumors
- C33_C34 - standardized mortality due to traumatic tumors of the trachea, bronchus and lungs
- I00_I99 - standardized mortality due to cardiovascular diseases
- J00_J99 – standardized mortality due to respiratory diseases
- J40_J47 - standardized mortality due to chronic lower respiratory tract disease

Description of further data for analysis and modeling:

- E_T – number of people who have completed education
- E_Uni – number of people with university education
- E_Hig – number of people with secondary education
- E_Voc – number of people with vocational education
- E_Pri – number of people with basic education
- E_N – number of people without education
- UnE_A – number of unemploeyed persons
- UnE_R – percentage of unemployed persons
- popul – number of people living in given location
- PM10 – the amount of larger particulate matters in the air (see chapter 5.1)
- PM25 – the amount of smaller particulate matters in the air (see chapter 5.2)
- NOx - the amount of nitrogen oxides in the air (see chapter 5.3)
- BAP – the amount of benzo(a)pyrene in the air (see chapter 5.4)

6.1 Analysis of Relations between Health Indicators and Socio-economic Factors in connection to the Territory

Only 2011 observations for men and women together ("YEAR 2011, SEX = both") were selected from the data, and the Pearson correlation coefficient was applied to them, along with the test of whether there was significant dependence between pairs of variables (if the p-value is less than the significance level of 0.05, then the dependence is significant).

Table 6.1: Pearson's correlation coefficient; YEAR 2011, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
E_T	N	0,355	N	N	N	N
E_Uni	N	N	0,258	N	N	N
E_Hig	N	0,326	0,327	N	N	N
E_Voc	N	0,346	0,254	N	N	N
E_Pri	0,254	0,350	N	0,265	0,307	0,308
E_N	0,291	N	N	0,480	0,527	0,324
UnE_A	N	0,418	0,338	N	N	N
UnE_R	N	N	N	0,416	0,579	0,394
popul	N	0,319	0,308	N	N	N

Source: ÚZIS, ČSÚ, SÚSR, VŠB-TUO, 2011, own processing

Note: N - no statistically significant, positive relationship between the variables was proven, E_T - number of people who have completed education, E_Uni - number of people with university education, E_Hig - - number of people with secondary education, E_Voc - number of people with vocational education, E_Pri - number of people with basic education, E_N - number of people without education, UnE_A - number of unemploeyed persons, UnE_R - percentage of unemployed persons, popul - number of people living in given location.

From the above correlation coefficients and related p-values the following **dependencies between mortality and socio-economic factors** can be observed:

- **Total standardized mortality** (A00_Y98) is dependent on the number of people without education in the region (increasing mortality rates) and on the number of people with basic education (increasing mortality rates).
- **Mortality due to malignant tumors** (C00_C97) depends on the number of inhabitants in the region (grows with increasing number of people), the number of unemployed people (grows with increasing numbers) and the number of undergraduates, apprentices, secondary and overall educated people (grows with increasing numbers).
- **Mortality due to traumatic tumors of the trachea, bronchus and lungs** (C33_C34) depends on the size of the population (grows with more people), the number of unemployed people (grows with increasing numbers), the number of uneducated persons (declines with increasing numbers) and the number of apprentices, secondary and university educated people (grows with increasing numbers).
- **Mortality due to cardiovascular diseases** (I00_I99) is dependent on the relative representation of the unemployed (grows with increasing number), the number of uneducated persons (grows with increasing number of people), the number of people with basic education (grows with increasing numbers) and the university educated (decreases with more numbers).
- **Mortality due to respiratory diseases** (J00_J99) is dependent on the percentage of unemployed (grows with increasing number), the number of uneducated persons (grows with increasing numbers), and the number of people with basic education (grows with increasing numbers).
- **Mortality due to chronic lower respiratory tract disease** (J40_J47) is dependent on the relative representation of the unemployed (grows with increasing number of people), the number of uneducated persons (grows with increasing numbers) and the number of persons with basic education (grows with increasing numbers).

6.2 Analysis of the Relationship between Health Indicators and Pollution in connection to the Territory

We apply the Pearson correlation coefficient, along with the test of whether significant dependence is found between the pairs of quantities. If the p-value is less than the significance level of 0.05, the dependence is significant and the coefficient is indicated by the "*" symbol.

Year=2007, SEX = both:

Table 6.2: Pearson's correlation coefficient; YEAR 2007, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	0,343	0,329	N	N	N
PM2,5	N	0,388	0,364	N	N	N
NOx	N	0,454	0,458	N	N	N
BAP	N	0,345	0,434	N	N	N

Source: ÚZIS, ČSÚ, SÚSR, VŠB-TUO, 2007, own processing. Note: N - no statistically significant, positive relationship between the variables was proven.

On the basis of p-values, it can be stated that in 2007 the dependence of cancer and lung disease in all pollutants investigated was proven - with increasing amount of these matters in the air the mortality rate increaes. Most of these deaths are affected by NO_2.

Year=2011, SEX = both:

Table 6.3: Pearson's correlation coefficient; YEAR 2011, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	N	N	N	N	N
PM2,5	N	N	0,299	N	N	N
NOx	N	N	0,37	N	N	N
BAP	N	N	N	N	N	N

Source: ÚZIS, ČSÚ, SÚSR, VŠB-TUO, 2011, own processing. Note: N - no statistically significant, positive relationship between the variables was proven.

In 2011, on the basis of p-values, the dependance of lung cancer on the amount of $PM_{2.5}$ and NO_2 in the air was determined. With their increase the mortality rate is rising. This dependance is more significant for the NO_2 pollutant.

Year=2015, SEX = both:

Table 6.4: Pearson's correlation coefficient; YEAR 2015, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	N	0,438	N	N	N
PM2,5	N	N	0,353	N	N	N
NOx	N	0,254	0,537	N	N	N
BAP	N	N	0,296	N	N	N

Source: ÚZIS, ČSÚ, SÚSR, VŠB-TUO, 2015, own processing. Note: N - no statistically significant, positive relationship between the variables was proven.

On the basis of the p-values, it can be stated that in 2015 the mortality rate for cancer is attributable only to the NO_x content in the air, with the increasing content also the mortality rises. Mortality rates for lung cancer are dependent on all factors this year, with increasing harmful matters in the air, the mortality rate increases.

6.3 Overall Comparison and Impact Determination

Classical linear regression has been applied to obtain dependence of standardized mortality rates on various demographic and pollution rates. Significant parameters are listed in the tables below in the "Factors" column. The models are judged by the so-called Determination Index (R^2), which measures the proportion of the explained variability of the dependent variable to its overall variability.

Dependence of mortality on individual pollutants and socio-economic factors is modeled using classical linear regression. A filter is applied to the data file for each study year (YEAR = 2007, 2011 and 2015), the gender of the population is not taken into account. There is a total of 65 subjects. For each SDR (standardized mortality rate, see Chapter 4), a model was built (searched using advanced methods). In each model, therefore, there are only significant dependencies, only those selected variables that are significantly affected by the SDR are included. Apart from the equation, which lists the explanatory variables together with their coefficients, the model is also evaluated by the determination index (generally in the range 0-1). Emphasis was placed on the model containing only significant dependencies and finding the best evaluated model (R^2).

Each of the six SDRs (from general A00-Y98 to the smallest J40-J47) was sequentially selected as the dependent variable. Modeling explanations for each SDR has been used to explain variables from the area of economic (unemployment and population size), education (number of educated persons) and air pollution (four different air pollution factors PM10, PM2,5, BAP and NOx). It should be noted that the variables pertaining to the achieved education are only for 2011. Using the appropriate linear regression model, for each SDR form, the ideal submodel was chosen in order to achieve the greatest clarity (dependency) of the SDR (measured by the R^2 determination index) and the model removed explanatory variables that do not affect SDR. The "Stepwise regression" and "All possible regressions" methods were applied.

Stepwise regression will only include those explanatory variables in the model based on the input parameters that cause a significant increase in dependency explanation. The advantage is the easy-to-use model, the disadvantage is often not finding a better-fit model (the method is based only on numeric values), and often does not finding the model at all.

The second method (All possible regressions) produces models of all existing combinations of explanatory variables. The disadvantage is more complex orientation in the results, while the model can be found even in cases where Stepwise regression does not find any model.

SEX="both" (both genders):

Table 6.5: Linear regression method; SEX = both

YEAR	SDR	R2	FACTORS
2007	A00-Y98	0,1740	PM2,5+
2007	C00-C97	0,2066	NOx+
2007	C33-C34	0,2095	NOx+
2007	I00-I99	---	-
2007	J00-J99	0,1038	PM2,5+
2007	J40-J47	---	-
2011	A00-Y98	0,3245	E_Hig+, E_Voc+, PM2,5+
2011	C00-C97	0,2593	PM2,5+, BAP-, UnE_A+
2011	C33-C34	0,2661	UnE_A+, NOx+
2011	I00-I99	0,3289	PM2,5+
2011	J00-J99	0,4267	E_N+, UnE_R+
2011	J40-J47	0,1555	UnE_R+
2015	A00-Y98	---	Nelze sestavit model
2015	C00-C97	0,0645	NOx+
2015	C33-C34	0,2881	NOx+
2015	I00-I99	0,0873	UnE_R+
2015	J00-J99	---	-
2015	J40-J47	0,2254	UnE_R+

Note: + indicate a positive impact on mortality.

SEX=“man“ (men):

Table 6.6: Linear regression method; SEX = man

YEAR	SDR	R2	FACTORS
2007	A00-Y98	0,1375	PM2,5+
2007	C00-C97	---	-
2007	C33-C34	0,1066	NOx+
2007	I00-I99	0,2380	-
2007	J00-J99	---	-
2007	J40-J47	---	-
2011	A00-Y98	---	-
2011	C00-C97	0,1175	PM2,5+
2011	C33-C34	---	-
2011	I00-I99	0,2414	PM2,5+
2011	J00-J99	---	-
2011	J40-J47	---	-
2015	A00-Y98	---	-
2015	C00-C97	---	-
2015	C33-C34	0,0848	NOx+
2015	I00-I99	---	-
2015	J00-J99	---	-
2015	J40-J47	---	-

Note: + indicate a positive impact on mortality.

SEX=“wom“ (women):

Table 6.7: Linear regression method; SEX = woman

YEAR	SDR	R2	FACTORS
2007	A00-Y98	0,1465	PM2,5+
2007	C00-C97	0,2740	NOx+
2007	C33-C34	0,3049	BAP+
2007	I00-I99	---	-
2007	J00-J99	---	-
2007	J40-J47	---	-
2011	A00-Y98	0,1547	PM2,5+
2011	C00-C97	0,1196	PM2,5+
2011	C33-C34	0,2041	NOx+
2011	I00-I99	---	-
2011	J00-J99	---	-
2011	J40-J47	---	-
2015	A00-Y98	---	-
2015	C00-C97	0,1274	NOx+
2015	C33-C34	0,3996	NOx+
2015	I00-I99	---	-
2015	J00-J99	---	-
2015	J40-J47	---	-

Note: + indicate a positive impact on mortality.

7 Summary inclduing Interpretation

7.1 Mortality Rate Analysis in NUTS2 Regions within EU

A significantly higher average was the male SDR compared to women. Total SDR was higher than the average of 28 EU countries in the countries surveyed; the Czech Republic and Poland reached comparable values, reaching significantly higher values in Slovakia. The order of the most significant causes of death did not differ in the three countries studied **- the most common cause of death was cardiovascular disease, followed by malignant tumors, respiratory diseases, lung cancer, and chronic lower respiratory tract diseases.**

Total mortality, as well as mortality in circulatory disease, is higher in the former Socialist bloc countries than in Western European countries. In addition to Eastern European countries, mortality on malignant tumors is concentrated in Croatia, Denmark and some regions of Scotland. Similarly, specific SDR values for lung cancer are shown. In assessing SDR for respiratory disease, the comparison of eastern European countries with other EU countries is much better than previous diagnosis - the highest values of SDR for respiratory system diseases in men are found in Great Britain, Ireland, Spain and Portugal, much more pronounced within the European NUTS2 high SDR for these diseases in women are found in the British Isles, Ireland, Denmark and Portugal.

In the NUTS2 TRITIA evaluation, the overall SDR and specific **SDR for malignant tumors and cardiovascular disease** are higher than the EU average, both regional and country values. For some specific mortality rates for both genders the values were lower than the EU average, e.g. SDR for lung cancer in the Czech Republic and in the Moravian-Silesian region, Slovakia and NUTS2 Central Slovakia or SDR for chronic diseases of the lower respiratory tract in Poland and both Polish NUTS2 and Slovakia and NUTS2 Central Slovakia.

The total standardized mortality rate of individual NUTS2 reaches the highest values in Central Slovakia, the lowest in the Opole Voivodeship, followed by the Silesian Voivodeship and the Moravian-Silesian region.

SDR for lung cancer is lower than the EU average for both genders in Central Slovakia and the Moravian-Silesian region, which is affected by the lower SDR of women in these malignancies. The lower death rate of women is also reflected in the Opole Voivodeship. On the contrary, EU values are exceeded for men's SDRs in all areas surveyed.

Most of the average European SDR values are exceeded for **SDR for cardiovascular disease**, in the Moravian-Silesian region, followed by the Zilina Region, the Silesian Voivodeship, and the best situation is in the Opole Voivodeship.

The **SDR values for respiratory diseases** show considerable variability between the NUTS2 regions of the TRITIA region - in the Silesian Voivodeship the values are the most favorable, in the Opole Voivods the values are also lower than the EU average. On the contrary, they are above the EU average in the Moravian-Silesian region, where they exceeded both the values of other areas and the values of the EU, as in the case of Central Slovakia.

7.2 Analysis of LAU1 Regions within TRITIA Area

7.2.1 Pollution

From the individual air pollutants in the regions in the three years under review, there are significant differences in air quality between areas. According to the air quality index, which aggregates the values of individual pollutants, the index value between the years in all monitored regions is decreasing.

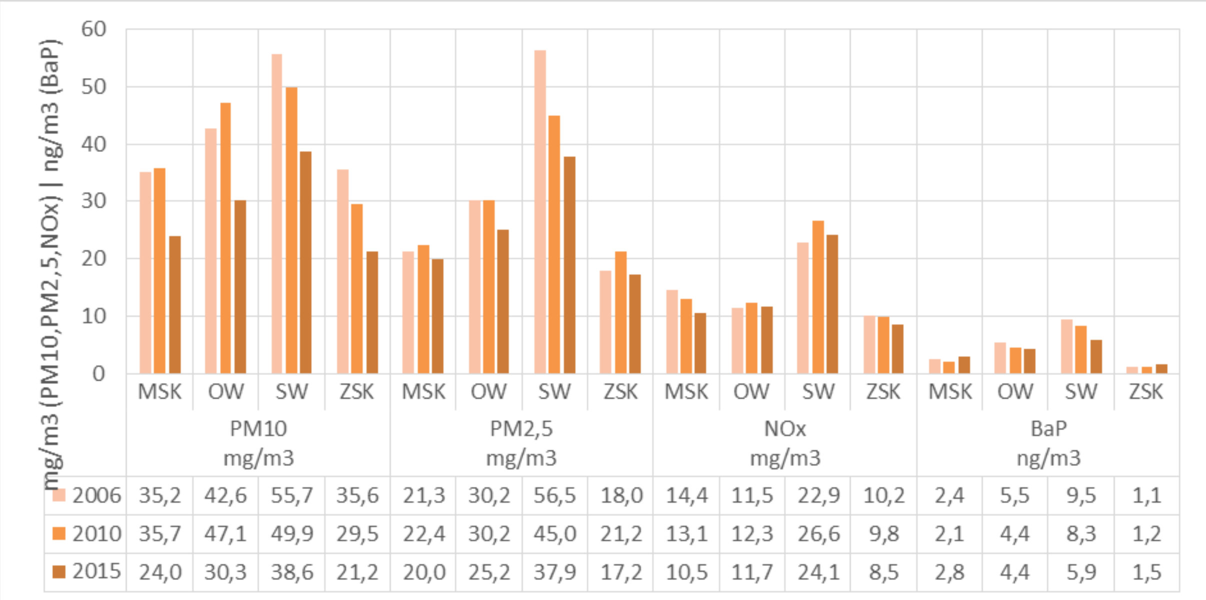
With regards to PM10, the situation is worse in the regions of Poland, on the contrary, the least polluted air with these particles is in the Zilina region. Overall, the level of PM10 in the air between 2007 and 2015 is decreasing.

By analyzing smaller PM2,5 particles the situation is similar, the most polluted Silesian Voivodeship is followed by the Opole, Moravian-Silesian region and the Zilina Region. The PM2.5 level decreased by 2015, surprisingly there was only a slight increase in the content of these particles in the Zilina Region in 2011.

NO_x particulate pollution is the largest in the Silesian Voivodeship, followed by the Moravian-Silesian region and the Opole Voivodeship. The NO_x concentration gradually decreased between 2007 and 2015, with Polish and Slovak regions showing a slight increase in the air in 2011.

The largest airborne burden with the last monitored substance (BAP) is the Silesian Voivodeship, which is followed by the Opole Voivodeship and the Moravian-Silesian region. In the Polish and Silesian Voivodeships, the BAP concentration is declining between 2007 and 2015, in the Moravian-Silesian region, the BAP concentration, slightly exceeds in 2007, after declining in 2011 in 2015.

Figure 7.1: Comparison of individual pollutants development by regions

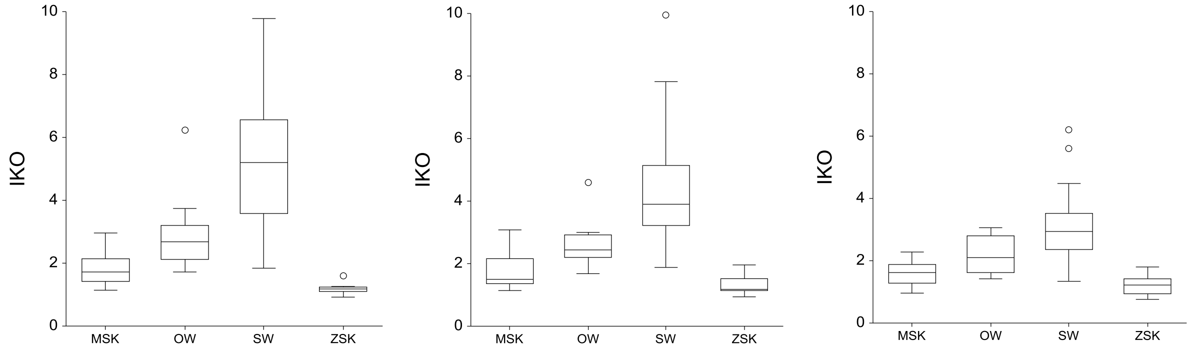


	PM10 mg/m3				PM2,5 mg/m3				NOx mg/m3				BaP ng/m3			
	MSK	OW	SW	ZSK	MSK	OW	SW	ZSK	MSK	OW	SW	ZSK	MSK	OW	SW	ZSK
2006	35,2	42,6	55,7	35,6	21,3	30,2	56,5	18,0	14,4	11,5	22,9	10,2	2,4	5,5	9,5	1,1
2010	35,7	47,1	49,9	29,5	22,4	30,2	45,0	21,2	13,1	12,3	26,6	9,8	2,1	4,4	8,3	1,2
2015	24,0	30,3	38,6	21,2	20,0	25,2	37,9	17,2	10,5	11,7	24,1	8,5	2,8	4,4	5,9	1,5

Source: VŠB-TUO, 2018

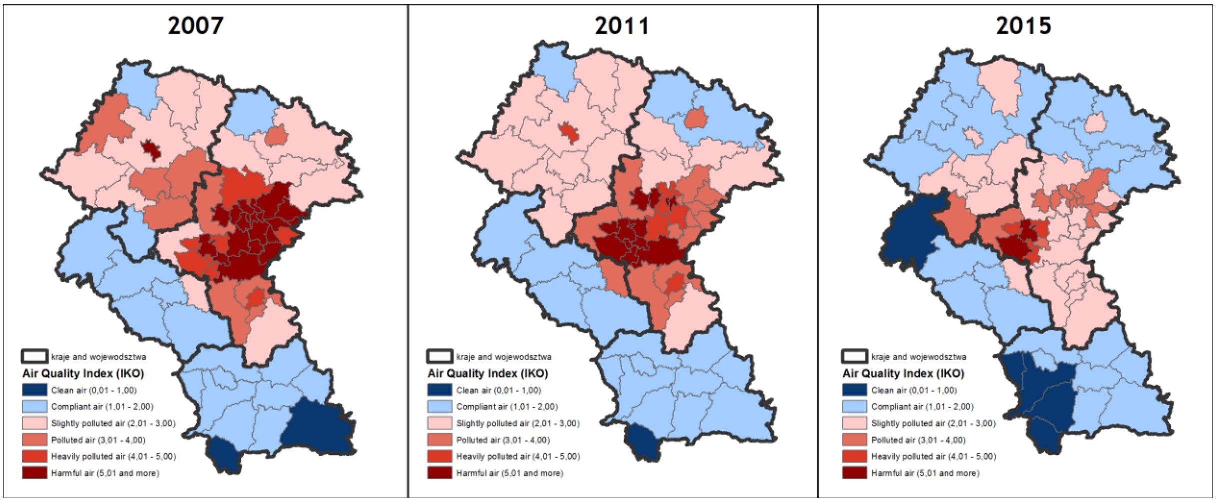
Of the four pollutants observed, the air quality index was calculated according to the methodology of the ZÚ, and consequently it derived categorization into six air pollution scales. It can be said that the highest quality is in the Zilina region, which is followed by the Moravian-Silesian region and the Opole Voivodeship. Air quality improved from 2007 to 2015, in the most affected areas, such as the Silesian Voivodeship, making visible changes for the better. The worst is the Rybnik and Wodzisławski areas, where the worst and harmful air was in 2015.

Figure 7.2: IKO index development (air quality index) in years 2007, 2011 and 2015



Source: VŠB-TUO, 2018, own processing

Figure 7.3: Air quality index in LAU 1 territorial units



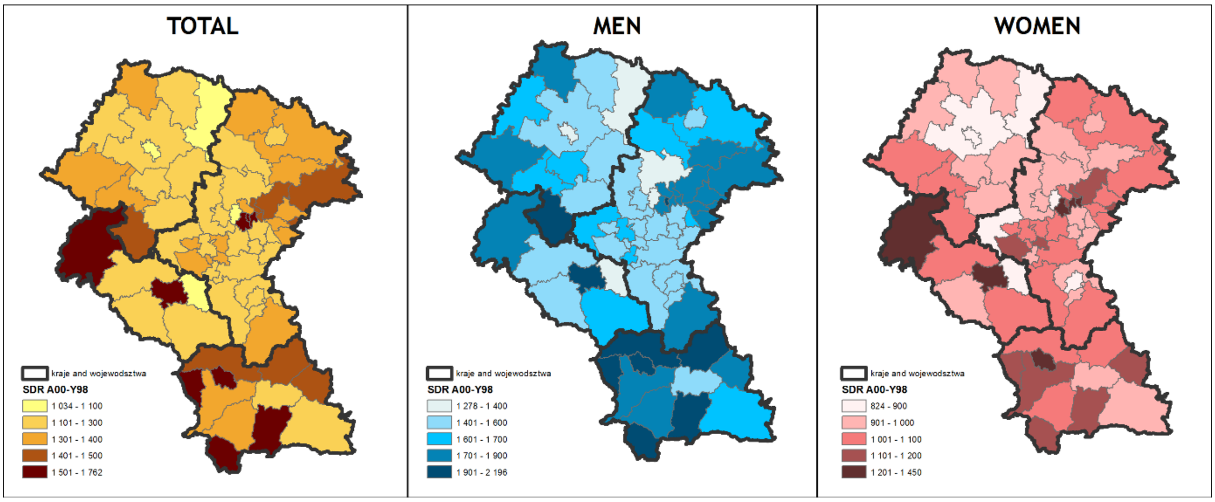
Source: VŠB-TUO, 2018, own processing

7.2.2 Mortality

When evaluating **LAU1 territorial units**, the increased values of the total and specific SDRs mainly pertain to the Moravian-Silesian region and the Zilina Region, the best values of the LAU1 are found in the Opole Voivodeship.

When using the output comparisons of the mortality of individual areas, it should be taken into mind that this is mainly the data from 2015, which needs to be interpreted with some caution in relation to year-to-year variability of data - the more specific cause of death with small frequencies in age groups (and overall), the greater the year-on-year variability.

Figure 7.4: Total standardized mortality in TRITIA region LAU1 broken down by gender



Source: ÚZIS, SÚSR, GÚS, 2018, own processing

Although it may appear that there are certain diagnoses that should logically be related to exposure to external or working environment factors, there are many confounding factors that affect these outcomes.

Socio-economic factors

From the correlation between mortality and socio-economic factors, the overall mortality rate (A00_Y98) is dependent on the number of people without education (increasing mortality rates) and the number of people with basic education (increasing mortality rates).

Tumor mortality (C00_C97), in addition to the size of the region's population (growing with population), is also rising with the rise in the number of the unemployed and those with a lower than university degree. Mortality in COPDs (C33_C34) is the higher the larger the population, the rising number of the unemployed, the falling number of uneducated persons, and the growing number of apprentices, high school and university educated people. It can be said that this mortality is higher in areas with higher unemployment and with medium and higher educated population.

Mortality of circulatory system diseases (I00_I99) is increased with the percentage of unemployed people, with more uneducated persons and those with basic education, and with fewer university educated people.

Mortality in respiratory diseases (J00_J99) is increased with higher relative proportions of the unemployed, with the number of uneducated persons and persons with basic education. Mortality rates for lower respiratory tract diseases (J40_J47) are higher where there is a higher relative proportion of the unemployed, higher numbers of uneducated persons and people with basic education (with more numbers growing). It can be summarized that, in addition apart from the size of the population, the mortality is particularly affected by unemployment and the level of education.

Table 7.1: Pearson's correlation coefficient; YEAR 2011, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
E_T	N	0,355	N	N	N	N
E_Uni	N	N	0,258	N	N	N
E_Hig	N	0,326	0,327	N	N	N
E_Voc	N	0,346	0,254	N	N	N
E_Pri	0,254	0,350	N	0,265	0,307	0,308
E_N	0,291	N	N	0,480	0,527	0,324

UnE_A	N	0,418	0,338	N	N	N
UnE_R	N	N	N	0,416	0,579	0,394
popul	N	0,319	0,308	N	N	N

Source: ČSÚ, SÚSR, GIG, ÚZIS, 2011, own processing

Note: N - Note: N - no statistically significant, positive relationship between the variables was proven

E_T - number of people who have completed education, E_Uni - number of people with university education, E_Hig - - number of people with secondary education, E_Voc - number of people with vocational education, E_Pri - number of people with basic education, E_N - number of people without education, UnE_A - number of unemploeyed persons, UnE_R - percentage of unemployed persons, popul - number of people living in given location.

Air quality factors

Similarly, with the help of the Pearson correlation coefficient, the mortality dependency on pollutants was investigated, where the following was found. Total mortality is not systematically dependent on polluting factors. Tumor morbidity is dependent on a higher NOx content in 2015. Mortality rates for lung cancer are increased by all polluting factors (PM10, PM2,5, NOx and BAP) in 2007 and 2015. In 2011, this mortality increases only PM2.5 and NOx.

Table 7.2: Pearson's correlation coefficient; YEAR 2007, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	0,343	0,329	N	N	N
PM2,5	N	0,388	0,364	N	N	N
NOx	N	0,454	0,458	N	N	N
BAP	N	0,345	0,434	N	N	N

Source: ČSÚ, SÚSR, GIG, ÚZIS, 2007, own processing

Note: N - no statistically significant, positive relationship between the variables was proven

Table 7.3: Pearson's correlation coefficient; YEAR 2011, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	N	N	N	N	N
PM2,5	N	N	0,299	N	N	N
NOx	N	N	0,37	N	N	N
BAP	N	N	N	N	N	N

Source: ČSÚ, SÚSR, GIG, ÚZIS, 2011, own processing

Note: N - no statistically significant, positive relationship between the variables was proven

Table 7.4: Pearson's correlation coefficient; YEAR 2015, SEX = both

	A00_Y98	C00_C97	C33_C34	I00_I99	J00_J99	J40_J47
PM10	N	N	0,438	N	N	N
PM2,5	N	N	0,353	N	N	N
NOx	N	0,254	0,537	N	N	N
BAP	N	N	0,296	N	N	N

Source: ČSÚ, SÚSR, GIG, ÚZIS, 2015, own processing

Note: N - no statistically significant, positive relationship between the variables was proven

8 Conclusion and Recommendations

The previous summary shows that among the most important factors influencing the health status of the population in the observed regions and years, especially the high NOx content, in the minority also BAP and PM2,5. By reducing all polluting factors, as shown by the current trend, the level of population health is substantially increased. In terms of socio-economic indicators, a higher rate of unemployment, in addition to a lower level of education, is seen as a major factor driving up some types of mortality.

Multidimensional linear regression was applied to modeling mortality dependence on all observed factors. From the models that were broken down by the three years under review and by the sex of the population, the following can be summarized:

- **In the entire population, mortality rates for cancer and lung cancer are significantly higher in the NOx range.**
- **In the male part of the population, the mortality rate on lung tumors is mainly influenced by a higher NOx content.**
- **In the female population, the mortality rate for cancer and lung cancer is affected by a higher content of NOx.**
- **In 2007, the high incidence of BaP was a major factor in higher lung mortality for lung cancer patients.**
- **In the whole population, mortality in circulatory diseases is increased with higher relative unemployment in the regions.**
- **In the male part of the population, the mortality rate for circulatory diseases is dependent on the higher PM2.5 content in the air.**
- **Mortality due to the lower respiratory tract diseases increases in the entire population, along with the share of the unemployed.**
- **Mortality in the lower respiratory tract is also affected by an increased number of people without education.**

Due to the fact that the monitored health indicators have different causes, we recommend that for other epidemiological studies, amongst the socio-economic factors, e.g. through lifestyle (e.g. smoking) and the monitoring of the economic level of individual areas through average incomes.

9 Annexes

9.1 Standardized Mortality Rate at LAU-1Level

Table 9.1: Summary table of standardized mortality rate on LAU-1 level

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2007	MSK	Bruntál	both	805,1	201,3	47,6	397,5	42,4	24,2
2007	MSK	Bruntál	man	1130,0	321,5	102,3	547,4	63,0	42,7
2007	MSK	Bruntál	wom	585,8	128,6	31,1	293,9	29,9	11,9
2007	MSK	Frýdek-Místek	both	786,2	196,0	72,1	378,2	45,4	15,7
2007	MSK	Frýdek-Místek	man	1044,9	264,0	16,2	477,6	68,9	33,6
2007	MSK	Frýdek-Místek	wom	581,1	146,2	113,3	302,6	30,5	6,3
2007	MSK	Karviná	both	832,2	217,6	39,0	411,5	41,1	16,0
2007	MSK	Karviná	man	1102,7	290,1	20,2	520,5	60,6	25,5
2007	MSK	Karviná	wom	622,4	163,2	37,9	330,3	28,9	9,8
2007	MSK	Nový Jičín	both	746,7	178,5	29,3	366,3	34,5	13,7
2007	MSK	Nový Jičín	man	981,1	252,4	22,3	429,3	61,4	27,6
2007	MSK	Nový Jičín	wom	559,2	130,2	83,3	309,1	15,6	4,0
2007	MSK	Opava	both	804,9	191,9	30,6	400,1	47,9	14,8
2007	MSK	Opava	man	1090,0	262,1	16,3	508,1	78,1	28,1
2007	MSK	Opava	wom	584,4	138,7	153,6	322,1	28,4	6,5
2007	MSK	Ostrava-město	both	843,9	215,5	31,2	406,6	42,8	15,1
2007	MSK	Ostrava-město	man	1105,8	287,3	32,5	511,4	64,9	23,6
2007	MSK	Ostrava-město	wom	649,4	165,8	22,7	328,7	28,5	10,3
2007	OW	brzeski	both	838,7	207,2	1,5	354,8	31,1	14,0
2007	OW	brzeski	man	1190,1	296,7	1,9	505,1	49,0	25,0
2007	OW	brzeski	wom	601,5	153,2	0,8	264,9	21,2	7,5
2007	OW	głubczycki	both	907,1	228,9	0,0	477,6	29,5	8,3
2007	OW	głubczycki	man	1268,3	274,6	0,0	716,2	54,0	23,1
2007	OW	głubczycki	wom	663,9	198,5	0,0	335,6	14,7	0,0
2007	OW	kędzierzyńsko-kozielski	both	767,5	184,4	0,0	341,9	40,9	18,2
2007	OW	kędzierzyńsko-kozielski	man	1011,1	249,1	0,0	428,7	57,5	27,5
2007	OW	kędzierzyńsko-kozielski	wom	571,0	132,4	0,0	276,4	28,6	9,3
2007	OW	kluczborski	both	800,5	200,4	0,0	391,3	33,4	8,0
2007	OW	kluczborski	man	1135,8	307,0	0,0	549,3	49,6	16,9
2007	OW	kluczborski	wom	544,9	121,0	0,0	275,0	23,9	3,1
2007	OW	krapkowicki	both	748,4	167,2	0,0	364,5	31,7	10,4
2007	OW	krapkowicki	man	950,6	240,9	0,0	417,3	55,1	22,5
2007	OW	krapkowicki	wom	567,8	116,6	0,0	304,2	16,8	2,6
2007	OW	m. Opole	both	673,0	180,4	0,0	312,1	41,5	13,1
2007	OW	m. Opole	man	879,4	224,5	0,0	374,4	68,4	19,5
2007	OW	m. Opole	wom	525,2	153,0	0,0	260,1	26,5	9,3
2007	OW	namysłowski	both	893,5	268,7	0,0	347,7	46,3	19,0
2007	OW	namysłowski	man	1258,5	383,5	0,0	472,6	83,6	36,3
2007	OW	namysłowski	wom	633,5	190,7	0,0	267,8	23,4	7,2
2007	OW	nyski	both	804,1	212,1	0,8	403,9	36,9	21,2
2007	OW	nyski	man	1134,4	308,1	1,6	542,3	66,1	43,1
2007	OW	nyski	wom	571,1	150,2	0,0	302,5	20,4	9,6
2007	OW	oleski	both	794,3	208,9	0,0	414,6	18,6	5,4
2007	OW	oleski	man	1141,2	318,9	0,0	562,2	26,7	9,1
2007	OW	oleski	wom	540,5	136,7	0,0	301,6	11,0	1,8
2007	OW	opolski	both	696,3	182,8	2,4	317,7	35,3	13,5
2007	OW	opolski	man	945,0	253,0	0,0	410,1	55,0	24,4
2007	OW	opolski	wom	501,1	134,4	4,1	241,5	21,4	6,6
2007	OW	prudnicki	both	879,0	198,1	0,0	461,1	31,6	12,4
2007	OW	prudnicki	man	1192,4	294,2	0,0	577,5	57,4	22,7
2007	OW	prudnicki	wom	647,5	136,3	0,0	370,7	17,4	7,4
2007	OW	strzelecki	both	786,4	183,6	0,0	425,4	42,2	20,1
2007	OW	strzelecki	man	1059,4	252,1	0,0	556,4	63,7	28,9
2007	OW	strzelecki	wom	576,2	130,2	0,0	331,9	29,6	12,3

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2007	SW	będziński	both	930,4	216,6	1,4	441,3	35,5	13,4
2007	SW	będziński	man	1337,3	316,0	2,3	594,7	65,8	25,8
2007	SW	będziński	wom	637,0	152,8	0,9	333,0	18,8	6,4
2007	SW	bielski	both	766,0	184,2	1,2	413,4	24,5	2,9
2007	SW	bielski	man	1019,8	254,5	0,0	528,3	34,7	2,9
2007	SW	bielski	wom	568,1	138,8	2,1	316,7	20,2	2,4
2007	SW	bieruńsko-lędziński	both	828,0	217,4	3,4	413,7	41,0	14,2
2007	SW	bieruńsko-lędziński	man	1121,7	264,4	6,8	575,6	72,9	23,2
2007	SW	bieruńsko-lędziński	wom	647,3	184,3	0,0	333,8	20,1	6,9
2007	SW	cieszyński	both	797,1	204,4	0,4	377,5	49,4	1,8
2007	SW	cieszyński	man	1021,3	272,1	1,1	447,8	71,6	2,2
2007	SW	cieszyński	wom	603,5	154,5	0,0	306,0	37,6	1,4
2007	SW	częstochowski	both	910,9	206,1	1,1	428,8	45,3	26,3
2007	SW	częstochowski	man	1304,3	295,5	2,5	559,8	94,9	64,4
2007	SW	częstochowski	wom	609,4	142,3	0,0	336,9	17,4	3,7
2007	SW	gliwicki	both	840,6	187,7	0,7	388,4	52,6	16,6
2007	SW	gliwicki	man	1159,7	269,1	1,6	480,5	94,6	39,0
2007	SW	gliwicki	wom	589,5	132,0	0,0	311,9	30,5	6,5
2007	SW	kłobucki	both	910,7	212,8	1,1	446,4	46,6	30,3
2007	SW	kłobucki	man	1256,9	328,7	2,3	537,6	85,1	69,3
2007	SW	kłobucki	wom	646,8	137,4	0,0	365,6	23,2	7,4
2007	SW	lubliniecki	both	815,5	194,6	4,7	415,0	31,6	18,5
2007	SW	lubliniecki	man	1127,0	268,1	0,0	534,5	55,5	26,5
2007	SW	lubliniecki	wom	590,2	137,8	7,7	332,2	22,8	13,5
2007	SW	m. Bielsko-Biała	both	770,7	198,6	1,9	395,9	26,8	1,3
2007	SW	m. Bielsko-Biała	man	1037,5	259,6	1,3	529,6	39,3	3,2
2007	SW	m. Bielsko-Biała	wom	591,8	161,7	1,9	308,2	18,4	0,6
2007	SW	m. Bytom	both	941,2	228,6	0,8	357,4	45,9	14,3
2007	SW	m. Bytom	man	1218,8	285,6	0,9	428,1	88,2	30,5
2007	SW	m. Bytom	wom	715,1	185,6	0,7	295,7	24,2	7,5
2007	SW	m. Częstochowa	both	876,0	205,8	0,3	381,2	46,3	22,7
2007	SW	m. Częstochowa	man	1207,0	286,5	0,7	477,1	73,0	41,7
2007	SW	m. Częstochowa	wom	629,6	154,5	0,0	310,9	27,9	11,0
2007	SW	m. Dąbrowa Górnicza	both	904,1	215,1	3,4	408,6	55,3	16,1
2007	SW	m. Dąbrowa Górnicza	man	1295,5	307,1	1,1	524,3	103,3	25,5
2007	SW	m. Dąbrowa Górnicza	wom	635,7	167,6	4,3	324,0	32,2	10,7
2007	SW	m. Gliwice	both	770,1	234,8	0,3	298,3	37,0	15,1
2007	SW	m. Gliwice	man	977,0	277,3	0,9	365,5	51,4	22,6
2007	SW	m. Gliwice	wom	604,1	203,6	0,0	241,7	27,2	9,7
2007	SW	m. Chorzów	both	1035,1	244,8	4,0	421,4	69,5	14,2
2007	SW	m. Chorzów	man	1371,0	318,2	4,2	503,7	103,5	28,7
2007	SW	m. Chorzów	wom	757,0	191,3	3,3	346,5	42,8	5,8
2007	SW	m. Jastrzębie-Zdrój	both	792,8	231,8	4,7	318,5	38,8	8,5
2007	SW	m. Jastrzębie-Zdrój	man	1090,9	315,2	15,9	458,3	52,8	15,3
2007	SW	m. Jastrzębie-Zdrój	wom	557,2	170,4	2,3	208,8	25,3	3,7
2007	SW	m. Jaworzno	both	849,2	234,6	1,3	391,7	40,2	16,6
2007	SW	m. Jaworzno	man	1182,2	367,5	2,0	499,0	67,7	35,6
2007	SW	m. Jaworzno	wom	595,2	143,4	1,1	302,6	23,1	5,2
2007	SW	m. Katowice	both	863,8	219,0	0,4	367,4	46,6	13,7
2007	SW	m. Katowice	man	1131,7	285,9	0,6	462,2	71,7	22,4
2007	SW	m. Katowice	wom	656,2	177,4	0,3	289,4	31,8	8,5
2007	SW	m. Mysłowice	both	954,2	280,4	1,2	408,6	46,2	26,8
2007	SW	m. Mysłowice	man	1268,4	364,1	0,0	498,4	88,4	55,1
2007	SW	m. Mysłowice	wom	731,4	232,5	2,3	333,0	23,9	15,2
2007	SW	m. Piekary Śląskie	both	906,8	201,8	3,2	446,1	50,2	16,8
2007	SW	m. Piekary Śląskie	man	1295,5	327,6	0,0	573,6	77,9	37,4
2007	SW	m. Piekary Śląskie	wom	624,5	120,1	6,0	346,8	33,9	6,7
2007	SW	m. Ruda Śląska	both	1040,3	240,4	2,7	458,8	43,6	18,9
2007	SW	m. Ruda Śląska	man	1346,6	315,5	4,5	551,3	82,7	41,8
2007	SW	m. Ruda Śląska	wom	783,9	189,4	1,2	369,3	22,2	7,4
2007	SW	m. Rybnik	both	831,2	220,5	1,1	368,1	45,5	16,6

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2007	SW	m. Rybnik	man	1139,4	294,8	1,2	477,4	88,3	32,2
2007	SW	m. Rybnik	wom	601,8	167,0	0,7	283,4	19,8	6,8
2007	SW	m. Siemianowice Śląskie	both	1021,5	276,4	1,1	460,4	52,8	17,4
2007	SW	m. Siemianowice Śląskie	man	1311,3	366,9	0,0	529,2	96,2	29,5
2007	SW	m. Siemianowice Śląskie	wom	767,8	217,6	1,8	376,5	26,3	8,2
2007	SW	m. Sosnowiec	both	900,8	233,0	0,2	390,1	43,7	14,5
2007	SW	m. Sosnowiec	man	1216,9	308,5	0,9	517,6	67,3	22,2
2007	SW	m. Sosnowiec	wom	672,5	182,4	0,0	301,9	31,0	11,0
2007	SW	m. Świętochłowice	both	1009,1	217,0	1,8	486,6	36,2	14,1
2007	SW	m. Świętochłowice	man	1351,7	285,0	0,0	636,3	48,7	17,5
2007	SW	m. Świętochłowice	wom	741,6	172,2	2,3	374,5	27,0	10,9
2007	SW	m. Tychy	both	822,4	203,5	2,7	388,8	45,0	13,3
2007	SW	m. Tychy	man	1122,8	322,3	3,4	483,6	78,6	32,5
2007	SW	m. Tychy	wom	616,6	126,6	1,7	318,2	28,1	3,8
2007	SW	m. Zabrze	both	769,7	209,8	1,9	279,5	36,7	16,2
2007	SW	m. Zabrze	man	968,2	247,9	2,0	340,9	60,8	27,0
2007	SW	m. Zabrze	wom	593,1	179,9	1,6	222,6	17,7	7,8
2007	SW	m. Żory	both	813,3	226,0	4,5	352,7	36,0	14,5
2007	SW	m. Żory	man	1212,2	280,9	3,6	586,0	43,9	18,4
2007	SW	m. Żory	wom	572,4	173,0	4,8	229,5	34,3	11,4
2007	SW	mikołowski	both	785,3	185,3	0,0	370,7	49,7	16,7
2007	SW	mikołowski	man	980,1	237,6	0,0	423,1	70,1	22,0
2007	SW	mikołowski	wom	628,4	159,3	0,0	316,4	33,9	11,2
2007	SW	myszkowski	both	926,9	217,8	0,0	448,6	38,5	19,6
2007	SW	myszkowski	man	1295,8	345,0	0,0	557,5	64,3	43,9
2007	SW	myszkowski	wom	640,8	129,2	0,0	364,7	22,6	5,5
2007	SW	pszczyński	both	807,9	200,7	0,0	448,7	18,8	1,8
2007	SW	pszczyński	man	1076,3	267,6	0,0	595,1	26,8	5,2
2007	SW	pszczyński	wom	587,3	155,6	0,0	330,7	13,0	0,0
2007	SW	raciborski	both	818,9	222,7	0,0	340,9	41,0	14,8
2007	SW	raciborski	man	1105,1	329,4	0,0	436,9	72,4	34,6
2007	SW	raciborski	wom	603,6	154,3	0,0	259,6	22,7	4,0
2007	SW	rybnicki	both	869,2	204,0	0,0	391,5	70,4	19,6
2007	SW	rybnicki	man	1117,0	294,8	0,0	494,4	91,7	31,3
2007	SW	rybnicki	wom	689,6	140,3	0,0	315,3	60,6	14,1
2007	SW	tarnogórski	both	778,2	194,0	0,0	367,8	38,6	14,1
2007	SW	tarnogórski	man	1027,2	272,1	0,0	447,5	57,7	20,7
2007	SW	tarnogórski	wom	567,6	139,5	0,0	291,5	27,5	9,8
2007	SW	wodzisławski	both	821,2	217,7	0,0	350,5	50,2	14,2
2007	SW	wodzisławski	man	1059,9	298,9	0,0	396,4	84,7	35,0
2007	SW	wodzisławski	wom	625,4	153,0	0,0	301,3	28,4	1,2
2007	SW	zawierciański	both	923,9	206,5	0,0	425,7	51,7	28,3
2007	SW	zawierciański	man	1246,4	298,4	0,0	539,4	78,9	48,4
2007	SW	zawierciański	wom	669,1	140,7	0,0	342,1	35,1	15,5
2007	SW	żywiecki	both	848,6	198,3	0,0	463,0	22,4	4,1
2007	SW	żywiecki	man	1200,6	294,5	0,0	637,3	29,0	6,2
2007	SW	żywiecki	wom	573,4	127,7	0,0	336,3	18,1	2,9
2007	ZSK	Bytča	both	1084,0	214,0	41,1	649,8	57,4	23,8
2007	ZSK	Bytča	man	1599,6	340,2	93,0	875,7	133,8	69,8
2007	ZSK	Bytča	wom	774,9	137,8	2,8	520,2	29,4	5,6
2007	ZSK	Čadca	both	1068,8	196,6	43,7	550,0	71,4	23,0
2007	ZSK	Čadca	man	1451,9	299,0	85,2	659,6	98,6	35,5
2007	ZSK	Čadca	wom	769,2	129,5	16,1	455,2	56,6	17,3
2007	ZSK	Dolný Kubín	both	892,7	240,9	29,0	458,9	64,8	17,6
2007	ZSK	Dolný Kubín	man	1200,0	317,4	55,4	594,4	94,3	41,6
2007	ZSK	Dolný Kubín	wom	642,7	179,0	10,2	355,3	37,1	3,6
2007	ZSK	Kysucké Nové Mesto	both	976,6	205,1	27,1	510,6	54,4	32,9
2007	ZSK	Kysucké Nové Mesto	man	1262,4	304,1	61,2	580,1	75,1	54,9
2007	ZSK	Kysucké Nové Mesto	wom	759,6	142,7	6,3	456,1	38,3	17,5
2007	ZSK	Liptovský Mikuláš	both	815,0	175,2	27,2	451,3	57,4	18,3
2007	ZSK	Liptovský Mikuláš	man	1171,7	275,3	64,4	609,3	97,3	38,6

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2007	ZSK	Liptovský Mikuláš	wom	562,0	112,4	3,7	342,9	31,9	6,0
2007	ZSK	Martin	both	808,7	182,2	25,7	407,9	65,6	15,3
2007	ZSK	Martin	man	1044,9	240,0	49,3	482,2	107,4	33,1
2007	ZSK	Martin	wom	619,2	142,1	8,4	344,2	36,4	5,2
2007	ZSK	Námestovo	both	1035,4	213,7	37,1	581,3	48,3	15,4
2007	ZSK	Námestovo	man	1286,4	318,6	80,7	574,2	94,5	36,4
2007	ZSK	Námestovo	wom	779,1	136,3	7,9	531,9	19,8	5,0
2007	ZSK	Ružomberok	both	912,2	189,2	33,6	538,6	41,5	6,2
2007	ZSK	Ružomberok	man	1286,1	283,5	57,9	739,6	76,6	11,0
2007	ZSK	Ružomberok	wom	672,8	131,1	23,4	417,5	20,8	2,3
2007	ZSK	Turčianske Teplice	both	1000,1	186,3	24,3	544,1	64,6	21,8
2007	ZSK	Turčianske Teplice	man	1391,1	276,8	59,0	700,3	125,6	57,7
2007	ZSK	Turčianske Teplice	wom	682,6	117,2	0,0	420,4	32,4	5,5
2007	ZSK	Tvrdošín	both	938,8	213,4	36,3	449,9	60,4	23,5
2007	ZSK	Tvrdošín	man	1407,6	307,2	70,1	687,2	90,9	49,7
2007	ZSK	Tvrdošín	wom	631,3	129,1	7,6	327,3	40,0	5,6
2007	ZSK	Žilina	both	857,3	195,2	29,6	444,6	49,3	20,4
2007	ZSK	Žilina	man	1138,3	269,1	55,8	551,7	80,3	31,2
2007	ZSK	Žilina	wom	648,2	146,4	9,9	363,3	30,3	14,1
2011	MSK	Bruntál	both	820,7	202,7	47,5	387,2	55,0	22,6
2011	MSK	Bruntál	man	1073,2	265,2	81,0	481,5	80,5	38,0
2011	MSK	Bruntál	wom	630,9	158,5	19,6	317,1	37,6	13,6
2011	MSK	Frýdek-Místek	both	780,3	186,6	29,9	369,9	42,9	22,4
2011	MSK	Frýdek-Místek	man	1035,8	258,1	53,5	456,9	70,2	37,3
2011	MSK	Frýdek-Místek	wom	586,4	137,9	13,1	302,5	26,9	13,1
2011	MSK	Karviná	both	847,3	215,1	43,5	422,4	36,4	21,2
2011	MSK	Karviná	man	1127,4	276,1	76,0	551,5	61,3	42,3
2011	MSK	Karviná	wom	632,2	170,3	19,1	326,2	21,5	8,7
2011	MSK	Nový Jičín	both	757,6	183,2	38,2	387,6	37,2	15,8
2011	MSK	Nový Jičín	man	986,7	240,5	59,9	464,2	63,1	30,9
2011	MSK	Nový Jičín	wom	574,4	143,7	21,5	323,2	19,6	5,6
2011	MSK	Opava	both	754,7	201,2	43,4	352,6	46,4	21,1
2011	MSK	Opava	man	1006,7	291,6	84,0	431,1	74,8	31,4
2011	MSK	Opava	wom	561,1	141,4	15,0	284,2	32,4	17,4
2011	MSK	Ostrava-město	both	828,5	219,8	47,5	367,8	48,0	19,8
2011	MSK	Ostrava-město	man	1121,5	308,6	81,8	477,7	72,4	31,8
2011	MSK	Ostrava-město	wom	608,4	157,5	22,1	288,0	32,3	12,3
2011	OW	brzeski	both	733,5	156,1	0,0	280,4	17,2	7,0
2011	OW	brzeski	man	956,9	198,9	0,0	333,1	32,3	14,8
2011	OW	brzeski	wom	549,0	129,6	0,0	238,0	7,7	2,3
2011	OW	głubczycki	both	819,5	160,8	1,6	403,2	45,5	7,4
2011	OW	głubczycki	man	1169,6	220,8	3,2	566,8	64,9	8,4
2011	OW	głubczycki	wom	569,0	126,0	0,0	290,2	31,6	7,0
2011	OW	kędzierzyńsko-kozielski	both	713,8	173,8	0,0	314,2	26,4	12,8
2011	OW	kędzierzyńsko-kozielski	man	941,0	241,2	0,0	400,4	42,1	21,1
2011	OW	kędzierzyńsko-kozielski	wom	526,4	128,2	0,0	234,7	14,8	7,1
2011	OW	kluczborski	both	747,9	193,1	1,3	324,0	33,4	14,8
2011	OW	kluczborski	man	1067,9	303,1	0,0	432,1	70,5	35,0
2011	OW	kluczborski	wom	532,0	127,4	2,7	247,8	10,8	1,1
2011	OW	krapkowicki	both	673,9	161,0	1,3	297,5	20,2	7,0
2011	OW	krapkowicki	man	908,5	228,4	0,0	388,5	41,1	11,9
2011	OW	krapkowicki	wom	492,2	123,1	2,7	227,2	10,4	4,2
2011	OW	m. Opole	both	611,3	168,6	0,0	259,2	35,7	13,1
2011	OW	m. Opole	man	798,9	218,4	0,0	337,3	52,8	18,6
2011	OW	m. Opole	wom	473,8	137,2	0,0	199,9	24,7	9,1
2011	OW	namysłowski	both	790,3	210,0	0,0	301,8	40,2	22,4
2011	OW	namysłowski	man	1085,0	274,6	0,0	406,6	70,1	34,3
2011	OW	namysłowski	wom	548,9	161,5	0,0	226,2	11,1	8,9
2011	OW	nyski	both	755,1	196,6	1,3	345,9	29,3	14,2
2011	OW	nyski	man	1022,1	285,9	0,0	435,5	46,1	25,6
2011	OW	nyski	wom	561,2	138,6	2,6	276,7	21,8	8,7

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2011	OW	oleski	both	682,5	172,1	0,0	358,0	13,0	3,5
2011	OW	oleski	man	935,6	263,6	0,0	475,3	28,5	6,8
2011	OW	oleski	wom	480,8	106,5	0,0	265,1	3,5	1,5
2011	OW	opolski	both	676,3	170,4	0,0	311,1	33,5	9,2
2011	OW	opolski	man	916,8	234,2	0,0	404,9	53,5	16,8
2011	OW	opolski	wom	495,1	129,2	0,0	240,3	19,2	3,5
2011	OW	prudnicki	both	770,6	185,9	2,0	379,4	23,9	11,3
2011	OW	prudnicki	man	1079,8	264,6	0,0	503,7	35,4	19,4
2011	OW	prudnicki	wom	544,4	136,9	3,6	288,1	15,7	5,0
2011	OW	strzelecki	both	706,4	155,4	0,0	362,3	26,8	10,9
2011	OW	strzelecki	man	983,9	208,8	0,0	499,2	43,8	18,4
2011	OW	strzelecki	wom	493,4	113,2	0,0	267,9	15,5	5,4
2011	SW	będziński	both	819,4	183,1	0,5	381,3	24,9	9,1
2011	SW	będziński	man	1123,9	247,8	1,0	490,6	37,2	19,4
2011	SW	będziński	wom	586,0	142,2	0,0	299,1	17,5	3,8
2011	SW	bielski	both	725,4	191,7	0,7	350,6	21,6	2,8
2011	SW	bielski	man	961,3	249,5	1,4	456,8	30,4	3,4
2011	SW	bielski	wom	551,4	150,2	0,0	276,1	15,2	2,1
2011	SW	bieruńsko-lędziński	both	668,0	147,4	0,0	294,7	36,4	13,6
2011	SW	bieruńsko-lędziński	man	833,4	170,3	0,0	338,0	67,9	29,1
2011	SW	bieruńsko-lędziński	wom	501,7	126,7	0,0	238,2	13,8	2,4
2011	SW	cieszyński	both	765,7	182,3	0,9	352,4	43,9	2,7
2011	SW	cieszyński	man	990,1	240,8	2,0	437,5	54,8	4,1
2011	SW	cieszyński	wom	588,7	141,3	0,0	278,5	36,3	2,0
2011	SW	częstochowski	both	805,3	185,1	1,4	361,8	35,4	19,8
2011	SW	częstochowski	man	1145,4	262,2	3,0	467,6	69,1	38,6
2011	SW	częstochowski	wom	535,9	129,1	0,0	278,8	16,8	10,1
2011	SW	gliwicki	both	765,1	178,7	3,4	324,2	33,2	22,3
2011	SW	gliwicki	man	1009,0	256,9	3,1	382,3	47,6	38,8
2011	SW	gliwicki	wom	555,7	122,1	3,7	269,5	24,2	13,0
2011	SW	kłobucki	both	701,1	182,2	0,7	299,2	25,5	17,8
2011	SW	kłobucki	man	978,6	267,5	0,0	361,4	49,5	40,3
2011	SW	kłobucki	wom	475,4	122,9	1,2	248,8	10,2	4,7
2011	SW	lubliniecki	both	777,1	169,0	3,1	378,7	29,3	14,3
2011	SW	lubliniecki	man	1006,2	187,9	4,8	454,2	48,7	27,9
2011	SW	lubliniecki	wom	574,8	152,4	1,4	304,8	15,3	5,4
2011	SW	m. Bielsko-Biała	both	669,9	183,4	0,4	319,4	21,8	0,9
2011	SW	m. Bielsko-Biała	man	946,6	256,8	0,9	455,3	26,9	1,2
2011	SW	m. Bielsko-Biała	wom	481,3	138,0	0,0	229,2	17,5	0,5
2011	SW	m. Bytom	both	851,8	232,6	0,0	326,4	41,9	14,5
2011	SW	m. Bytom	man	1178,6	320,5	0,0	429,4	68,1	24,4
2011	SW	m. Bytom	wom	606,4	171,7	0,0	251,1	22,4	7,7
2011	SW	m. Częstochowa	both	770,3	200,1	1,0	319,1	30,8	11,6
2011	SW	m. Częstochowa	man	1073,4	280,4	0,8	415,7	44,3	16,8
2011	SW	m. Częstochowa	wom	556,5	150,3	1,0	252,4	23,7	8,3
2011	SW	m. Dąbrowa Górnicza	both	883,4	226,1	2,7	366,3	43,3	15,6
2011	SW	m. Dąbrowa Górnicza	man	1217,2	294,4	5,0	467,4	82,0	30,7
2011	SW	m. Dąbrowa Górnicza	wom	640,7	181,6	0,8	289,2	24,7	7,7
2011	SW	m. Gliwice	both	763,0	189,8	1,0	297,0	29,9	13,1
2011	SW	m. Gliwice	man	985,9	235,5	0,8	379,8	38,5	18,4
2011	SW	m. Gliwice	wom	583,9	162,0	1,1	231,5	21,8	9,9
2011	SW	m. Chorzów	both	965,8	225,3	1,9	375,9	41,4	14,7
2011	SW	m. Chorzów	man	1337,8	301,6	0,0	524,6	63,6	28,8
2011	SW	m. Chorzów	wom	680,5	174,8	2,6	278,9	23,6	6,7
2011	SW	m. Jastrzębie-Zdrój	both	739,1	196,2	0,0	302,2	35,2	9,7
2011	SW	m. Jastrzębie-Zdrój	man	900,6	229,3	0,0	330,3	42,0	9,3
2011	SW	m. Jastrzębie-Zdrój	wom	573,0	161,2	0,0	262,2	27,6	7,7
2011	SW	m. Jaworzno	both	808,3	195,4	0,5	362,2	36,2	10,1
2011	SW	m. Jaworzno	man	1071,7	262,4	0,0	452,1	66,6	20,8
2011	SW	m. Jaworzno	wom	596,0	148,7	0,8	288,8	15,2	4,3
2011	SW	m. Katowice	both	789,4	195,2	1,1	339,8	28,4	13,3

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2011	SW	m. Katowice	man	1048,3	261,4	1,1	438,4	42,3	20,3
2011	SW	m. Katowice	wom	587,4	151,0	0,8	262,8	19,0	9,9
2011	SW	m. Mysłowice	both	796,9	213,0	2,4	385,0	20,5	7,7
2011	SW	m. Mysłowice	man	955,7	251,7	0,0	431,7	34,9	7,8
2011	SW	m. Mysłowice	wom	633,1	188,3	4,8	320,9	8,8	7,0
2011	SW	m. Piekary Śląskie	both	910,1	191,2	0,0	439,2	46,7	19,8
2011	SW	m. Piekary Śląskie	man	1206,7	248,6	0,0	586,4	74,0	42,5
2011	SW	m. Piekary Śląskie	wom	686,9	152,7	0,0	329,2	29,6	4,2
2011	SW	m. Ruda Śląska	both	910,4	234,6	1,0	350,5	45,5	26,2
2011	SW	m. Ruda Śląska	man	1188,1	317,4	2,5	421,5	81,1	49,5
2011	SW	m. Ruda Śląska	wom	699,1	184,1	0,0	291,1	27,2	14,8
2011	SW	m. Rybnik	both	743,3	188,8	0,5	310,9	38,3	11,3
2011	SW	m. Rybnik	man	1023,4	245,5	0,0	445,3	58,8	21,3
2011	SW	m. Rybnik	wom	539,2	149,0	0,9	220,7	25,4	5,7
2011	SW	m. Siemianowice Śląskie	both	872,8	207,7	4,2	385,7	38,7	24,9
2011	SW	m. Siemianowice Śląskie	man	1188,3	277,2	3,2	526,7	55,0	36,2
2011	SW	m. Siemianowice Śląskie	wom	653,3	158,5	3,8	302,3	30,0	17,8
2011	SW	m. Sosnowiec	both	829,6	199,9	0,4	365,4	35,0	8,1
2011	SW	m. Sosnowiec	man	1158,5	277,4	0,7	490,9	62,8	18,8
2011	SW	m. Sosnowiec	wom	604,5	152,7	0,3	282,6	18,9	2,3
2011	SW	m. Świętochłowice	both	945,0	180,9	2,2	391,9	42,1	17,9
2011	SW	m. Świętochłowice	man	1223,5	208,7	0,0	514,0	64,9	33,9
2011	SW	m. Świętochłowice	wom	698,0	156,8	3,2	291,7	25,6	8,2
2011	SW	m. Tychy	both	744,1	177,1	1,7	330,4	33,7	14,1
2011	SW	m. Tychy	man	1007,8	254,3	1,1	414,9	54,9	28,7
2011	SW	m. Tychy	wom	529,8	126,7	1,8	255,1	18,9	5,4
2011	SW	m. Zabrze	both	744,9	194,6	0,3	246,5	26,1	12,0
2011	SW	m. Zabrze	man	976,9	251,1	0,0	296,8	39,9	21,6
2011	SW	m. Zabrze	wom	543,7	152,0	0,6	198,3	15,7	4,7
2011	SW	m. Żory	both	694,8	173,7	2,5	312,9	14,8	5,8
2011	SW	m. Żory	man	853,4	197,8	0,0	401,6	19,6	9,8
2011	SW	m. Żory	wom	561,5	150,4	3,2	255,4	7,9	1,9
2011	SW	mikołowski	both	760,9	181,2	1,9	360,7	23,9	6,2
2011	SW	mikołowski	man	976,7	250,0	4,5	417,8	34,7	10,0
2011	SW	mikołowski	wom	575,9	132,3	0,0	304,5	17,1	3,3
2011	SW	myszkowski	both	762,8	183,5	5,1	357,4	26,5	9,3
2011	SW	myszkowski	man	1037,1	249,6	9,2	491,9	34,7	16,5
2011	SW	myszkowski	wom	543,8	140,0	1,9	254,0	20,8	4,8
2011	SW	pszczyński	both	710,7	163,8	0,0	377,9	23,2	2,9
2011	SW	pszczyński	man	958,5	250,2	0,0	462,3	30,7	4,7
2011	SW	pszczyński	wom	516,1	107,6	0,0	306,0	19,3	1,3
2011	SW	raciborski	both	701,9	166,9	0,5	276,9	22,9	11,9
2011	SW	raciborski	man	901,2	205,2	1,3	350,8	44,5	22,9
2011	SW	raciborski	wom	543,8	140,4	0,0	222,4	12,8	5,9
2011	SW	rybnicki	both	763,5	153,3	1,2	350,6	40,1	17,5
2011	SW	rybnicki	man	1034,1	218,9	2,4	447,4	59,3	30,4
2011	SW	rybnicki	wom	556,4	105,8	0,0	277,6	31,4	11,5
2011	SW	tarnogórski	both	721,5	174,0	0,0	339,9	29,7	17,9
2011	SW	tarnogórski	man	957,4	235,0	0,0	445,5	43,8	31,8
2011	SW	tarnogórski	wom	518,5	129,6	0,0	249,4	21,0	8,9
2011	SW	wodzisławski	both	785,4	194,9	0,6	313,7	42,4	17,3
2011	SW	wodzisławski	man	1056,5	276,5	1,2	388,1	72,8	31,5
2011	SW	wodzisławski	wom	573,4	141,8	0,0	256,2	21,4	8,0
2011	SW	zawierciański	both	835,1	198,9	1,3	355,7	39,6	20,3
2011	SW	zawierciański	man	1102,8	262,5	0,0	449,0	47,8	26,9
2011	SW	zawierciański	wom	611,7	149,9	2,5	281,3	34,4	16,1
2011	SW	żywiecki	both	781,8	193,8	0,0	399,2	23,0	2,5
2011	SW	żywiecki	man	1069,4	276,5	0,0	530,6	35,5	1,2
2011	SW	żywiecki	wom	574,8	141,3	0,0	303,6	15,4	3,4
2011	ZSK	Bytča	both	849,2	183,5	23,5	447,7	39,3	21,1
2011	ZSK	Bytča	man	1137,0	240,5	40,2	567,1	101,4	54,2

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2011	ZSK	Bytča	wom	603,2	136,6	12,3	326,3	8,8	8,8
2011	ZSK	Čadca	both	987,5	201,1	28,0	513,7	71,1	24,4
2011	ZSK	Čadca	man	1381,5	288,7	60,7	650,1	140,0	62,9
2011	ZSK	Čadca	wom	700,6	142,9	6,2	410,8	27,3	4,1
2011	ZSK	Dolný Kubín	both	796,0	203,5	46,0	362,1	43,1	11,5
2011	ZSK	Dolný Kubín	man	1069,9	280,5	103,1	468,1	97,3	22,3
2011	ZSK	Dolný Kubín	wom	570,2	136,7	4,3	271,8	12,6	5,8
2011	ZSK	Kysucké Nové Mesto	both	818,9	209,5	35,8	399,9	44,3	15,6
2011	ZSK	Kysucké Nové Mesto	man	1129,2	281,7	70,8	492,6	82,6	35,9
2011	ZSK	Kysucké Nové Mesto	wom	584,2	151,7	9,0	331,0	20,3	4,0
2011	ZSK	Liptovský Mikuláš	both	671,7	165,2	30,1	354,4	50,8	10,4
2011	ZSK	Liptovský Mikuláš	man	919,1	244,2	65,4	445,9	86,9	25,5
2011	ZSK	Liptovský Mikuláš	wom	504,0	113,2	8,0	291,0	27,5	1,4
2011	ZSK	Martin	both	708,3	163,1	21,4	358,0	43,5	13,9
2011	ZSK	Martin	man	975,4	237,8	40,9	469,6	64,7	20,9
2011	ZSK	Martin	wom	507,0	112,7	6,9	276,5	31,7	10,5
2011	ZSK	Námestovo	both	868,5	186,9	14,4	400,6	79,5	28,3
2011	ZSK	Námestovo	man	1306,3	263,1	37,2	576,5	144,4	72,3
2011	ZSK	Námestovo	wom	582,4	139,3	0,0	293,6	48,3	6,4
2011	ZSK	Ružomberok	both	840,0	187,0	35,3	453,3	54,4	14,0
2011	ZSK	Ružomberok	man	1152,5	247,1	60,0	589,8	106,5	18,7
2011	ZSK	Ružomberok	wom	617,5	154,4	21,3	349,8	22,6	11,1
2011	ZSK	Turčianske Teplice	both	854,5	203,8	30,7	436,1	59,6	21,5
2011	ZSK	Turčianske Teplice	man	1116,5	249,6	65,2	547,3	110,3	30,1
2011	ZSK	Turčianske Teplice	wom	669,9	182,2	10,0	351,5	25,6	10,6
2011	ZSK	Tvrdošín	both	836,4	214,3	49,3	415,8	51,7	32,7
2011	ZSK	Tvrdošín	man	1043,9	328,5	118,1	465,2	81,2	71,1
2011	ZSK	Tvrdošín	wom	667,2	129,0	0,0	367,7	29,8	6,0
2011	ZSK	Žilina	both	797,7	184,8	27,4	416,3	39,8	17,9
2011	ZSK	Žilina	man	1091,6	263,0	57,0	522,9	60,5	30,6
2011	ZSK	Žilina	wom	580,1	131,2	7,4	337,4	25,0	9,9
2015	MSK	Bruntál	both	870,1	182,8	31,3	401,1	66,0	37,6
2015	MSK	Bruntál	man	1028,2	229,1	47,9	441,7	88,8	58,0
2015	MSK	Bruntál	wom	711,5	147,0	18,3	346,4	46,9	21,3
2015	MSK	Frýdek-Místek	both	712,2	153,3	26,8	338,7	40,0	17,3
2015	MSK	Frýdek-Místek	man	939,6	200,8	44,6	432,9	61,1	29,0
2015	MSK	Frýdek-Místek	wom	538,6	121,4	13,9	271,1	25,5	9,5
2015	MSK	Karviná	both	605,8	152,2	33,2	264,7	34,7	16,7
2015	MSK	Karviná	man	802,9	213,2	60,2	319,4	53,7	31,8
2015	MSK	Karviná	wom	447,9	107,0	13,0	217,3	23,4	7,8
2015	MSK	Nový Jičín	both	651,9	135,0	24,2	301,6	44,4	22,4
2015	MSK	Nový Jičín	man	877,1	189,7	43,7	386,9	59,5	35,1
2015	MSK	Nový Jičín	wom	466,8	95,9	10,4	229,9	32,6	12,3
2015	MSK	Opava	both	690,6	166,1	31,9	315,1	43,2	18,7
2015	MSK	Opava	man	905,9	224,4	49,8	395,1	63,9	32,3
2015	MSK	Opava	wom	514,9	126,6	18,6	247,4	28,3	9,2
2015	MSK	Ostrava-město	both	981,6	243,1	54,1	411,0	60,6	31,9
2015	MSK	Ostrava-město	man	1250,4	309,0	87,9	518,4	91,7	51,6
2015	MSK	Ostrava-město	wom	773,8	197,2	31,5	326,1	40,2	19,0
2015	OW	brzeski	both	851,0	216,9	0,0	310,5	67,9	12,1
2015	OW	brzeski	man	459,4	103,4	0,0	167,1	31,7	3,5
2015	OW	brzeski	wom	1063,4	330,0	0,0	447,4	105,0	25,1
2015	OW	głubczycki	both	995,3	180,1	0,0	462,1	102,7	6,0
2015	OW	głubczycki	man	570,6	104,2	0,0	253,9	59,1	3,1
2015	OW	głubczycki	wom	1119,5	230,4	0,0	590,3	102,2	5,1
2015	OW	kędzierzyńsko-kozielski	both	1014,3	248,0	2,6	355,4	63,2	15,2
2015	OW	kędzierzyńsko-kozielski	man	462,3	115,6	0,9	161,0	30,8	7,6
2015	OW	kędzierzyńsko-kozielski	wom	931,8	171,1	1,7	469,4	55,2	11,9
2015	OW	kluczborski	both	890,0	247,3	2,9	313,3	34,7	8,3
2015	OW	kluczborski	man	478,7	126,9	1,7	176,2	21,8	6,8
2015	OW	kluczborski	wom	945,1	273,2	3,2	416,4	29,0	4,8

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2015	OW	krapkowicki	both	777,8	217,1	0,0	311,3	54,1	16,9
2015	OW	krapkowicki	man	388,1	106,3	0,0	157,0	33,7	11,5
2015	OW	krapkowicki	wom	850,3	218,2	0,0	419,8	45,9	9,2
2015	OW	m. Opole	both	587,3	156,8	1,2	241,5	50,6	8,6
2015	OW	m. Opole	man	784,8	203,5	1,2	318,5	58,8	12,5
2015	OW	m. Opole	wom	441,5	126,7	1,1	184,5	45,0	5,9
2015	OW	namysłowski	both	891,6	263,6	0,0	333,4	53,4	11,7
2015	OW	namysłowski	man	540,5	146,9	0,0	211,9	35,6	11,3
2015	OW	namysłowski	wom	1012,6	328,2	0,0	436,2	66,6	0,0
2015	OW	nyski	both	974,9	251,2	5,3	394,0	80,3	15,2
2015	OW	nyski	man	521,8	124,5	2,8	217,5	44,5	5,3
2015	OW	nyski	wom	1042,7	303,3	3,1	490,9	72,9	22,4
2015	OW	oleski	both	750,8	232,7	1,4	296,0	53,9	10,8
2015	OW	oleski	man	362,0	99,4	0,0	147,4	22,5	7,5
2015	OW	oleski	wom	755,2	227,6	2,7	361,6	56,2	4,2
2015	OW	opolski	both	768,4	209,5	0,0	305,0	74,6	7,1
2015	OW	opolski	man	352,9	83,0	0,0	149,3	33,6	3,7
2015	OW	opolski	wom	793,7	234,4	0,0	346,0	74,4	5,3
2015	OW	prudnicki	both	956,7	254,6	6,6	385,7	56,6	12,5
2015	OW	prudnicki	man	512,5	144,4	3,7	197,7	27,7	9,1
2015	OW	prudnicki	wom	981,2	222,7	3,7	532,2	54,6	5,7
2015	OW	strzelecki	both	843,8	210,3	2,3	355,0	60,8	9,3
2015	OW	strzelecki	man	404,2	93,8	1,3	170,9	33,7	6,5
2015	OW	strzelecki	wom	855,7	192,2	0,0	468,7	37,9	5,0
2015	SW	będziński	both	1308,8	369,3	1,1	495,1	40,2	5,3
2015	SW	będziński	man	586,9	155,2	0,0	225,3	15,4	1,4
2015	SW	będziński	wom	1154,5	348,2	3,4	512,3	42,4	8,0
2015	SW	bielski	both	728,8	233,0	0,0	271,4	26,5	2,6
2015	SW	bielski	man	412,1	126,6	0,0	151,4	15,6	1,5
2015	SW	bielski	wom	935,5	313,1	0,0	428,6	34,8	4,5
2015	SW	bieruńsko-lędziński	both	771,9	278,9	0,4	226,1	33,4	6,8
2015	SW	bieruńsko-lędziński	man	395,5	128,9	0,4	109,5	21,4	5,8
2015	SW	bieruńsko-lędziński	wom	982,7	320,8	0,0	455,2	29,6	1,9
2015	SW	cieszyński	both	827,0	238,3	0,8	302,9	57,3	0,6
2015	SW	cieszyński	man	439,7	116,2	0,6	166,7	31,1	0,6
2015	SW	cieszyński	wom	1018,1	308,3	0,0	446,7	68,8	0,0
2015	SW	częstochowski	both	937,9	225,8	1,7	347,2	27,8	14,6
2015	SW	częstochowski	man	501,3	115,9	0,0	167,5	17,7	11,4
2015	SW	częstochowski	wom	958,6	253,9	2,3	493,1	24,7	6,9
2015	SW	gliwicki	both	904,8	226,8	1,0	300,1	46,1	20,4
2015	SW	gliwicki	man	450,8	111,3	0,0	141,0	24,5	15,7
2015	SW	gliwicki	wom	957,1	224,1	2,9	447,2	30,5	7,7
2015	SW	kłobucki	both	831,6	263,5	4,0	275,6	37,0	23,6
2015	SW	kłobucki	man	468,3	147,7	2,3	143,2	18,6	11,6
2015	SW	kłobucki	wom	966,8	293,4	4,9	437,9	50,7	32,6
2015	SW	lubliniecki	both	827,4	234,2	1,0	292,0	53,0	26,7
2015	SW	lubliniecki	man	457,5	116,5	0,0	159,2	36,3	20,4
2015	SW	lubliniecki	wom	954,8	274,6	3,1	452,9	23,7	11,3
2015	SW	m. Bielsko-Biała	both	638,5	199,3	0,0	281,6	25,7	0,8
2015	SW	m. Bielsko-Biała	man	880,9	275,5	0,0	359,1	39,4	0,8
2015	SW	m. Bielsko-Biała	wom	467,0	151,9	0,0	223,7	19,3	0,8
2015	SW	m. Bytom	both	837,9	210,5	0,8	331,3	25,2	13,4
2015	SW	m. Bytom	man	1092,3	268,2	0,0	422,0	39,5	20,2
2015	SW	m. Bytom	wom	636,6	175,5	1,4	257,3	15,4	10,1
2015	SW	m. Częstochowa	both	722,0	185,9	1,3	286,8	26,4	9,2
2015	SW	m. Częstochowa	man	983,7	243,0	1,5	374,8	41,0	14,5
2015	SW	m. Częstochowa	wom	522,6	147,9	1,4	222,6	17,3	7,1
2015	SW	m. Dąbrowa Górnicza	both	781,6	193,7	0,0	359,3	37,6	2,7
2015	SW	m. Dąbrowa Górnicza	man	1028,1	257,1	0,0	443,5	58,4	2,0
2015	SW	m. Dąbrowa Górnicza	wom	595,4	151,9	0,0	297,3	26,9	3,1
2015	SW	m. Gliwice	both	699,2	188,6	1,3	273,5	24,4	12,8

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2015	SW	m. Gliwice	man	911,5	231,9	0,8	349,2	38,2	20,9
2015	SW	m. Gliwice	wom	526,7	157,8	1,8	214,0	14,2	6,8
2015	SW	m. Chorzów	both	898,2	231,7	2,5	350,3	35,7	25,0
2015	SW	m. Chorzów	man	1140,4	293,9	2,9	408,8	39,6	29,1
2015	SW	m. Chorzów	wom	703,2	194,6	1,7	294,2	32,8	22,1
2015	SW	m. Jastrzębie-Zdrój	both	736,5	209,3	0,0	306,2	39,9	2,3
2015	SW	m. Jastrzębie-Zdrój	man	1011,2	271,1	0,0	412,6	57,4	7,6
2015	SW	m. Jastrzębie-Zdrój	wom	513,6	167,2	0,0	217,8	28,7	0,0
2015	SW	m. Jaworzno	both	798,3	200,5	0,0	376,2	46,5	2,5
2015	SW	m. Jaworzno	man	1050,2	269,2	0,0	496,3	66,3	2,1
2015	SW	m. Jaworzno	wom	604,2	151,3	0,0	282,3	33,3	2,5
2015	SW	m. Katowice	both	735,7	197,0	1,9	286,4	28,7	13,2
2015	SW	m. Katowice	man	933,6	249,5	2,0	355,7	38,5	17,6
2015	SW	m. Katowice	wom	574,2	162,6	2,0	224,3	21,9	10,1
2015	SW	m. Mysłowice	both	727,6	189,5	0,0	325,4	30,5	4,2
2015	SW	m. Mysłowice	man	981,8	230,5	0,0	429,3	60,2	6,3
2015	SW	m. Mysłowice	wom	533,8	160,9	0,0	245,1	13,8	3,7
2015	SW	m. Piekary Śląskie	both	847,8	212,3	1,3	371,9	20,7	10,9
2015	SW	m. Piekary Śląskie	man	1076,5	322,3	0,0	427,7	32,6	16,2
2015	SW	m. Piekary Śląskie	wom	662,8	141,2	2,4	318,7	13,9	8,6
2015	SW	m. Ruda Śląska	both	907,4	222,5	1,3	347,0	47,8	22,7
2015	SW	m. Ruda Śląska	man	1149,8	285,9	2,9	405,0	78,9	36,7
2015	SW	m. Ruda Śląska	wom	703,8	178,6	0,0	294,6	26,5	14,4
2015	SW	m. Rybnik	both	747,3	204,4	0,0	287,1	66,7	3,4
2015	SW	m. Rybnik	man	976,7	280,3	0,0	361,0	94,8	5,0
2015	SW	m. Rybnik	wom	555,8	144,3	0,0	231,3	44,3	2,0
2015	SW	m. Siemianowice Śląskie	both	853,6	239,9	0,0	323,9	35,1	19,5
2015	SW	m. Siemianowice Śląskie	man	1042,6	288,8	0,0	344,4	67,8	39,6
2015	SW	m. Siemianowice Śląskie	wom	700,3	213,8	0,0	285,4	14,4	7,9
2015	SW	m. Sosnowiec	both	793,3	204,2	0,0	354,9	31,1	2,3
2015	SW	m. Sosnowiec	man	1085,9	283,3	0,0	468,8	39,2	2,6
2015	SW	m. Sosnowiec	wom	568,3	152,6	0,0	267,0	25,9	1,9
2015	SW	m. Świętochłowice	both	977,2	243,2	1,0	371,8	37,1	8,8
2015	SW	m. Świętochłowice	man	1325,2	311,5	2,7	487,9	64,2	11,0
2015	SW	m. Świętochłowice	wom	673,4	192,5	0,0	269,4	12,1	6,7
2015	SW	m. Tychy	both	684,3	187,3	1,8	290,9	29,0	15,0
2015	SW	m. Tychy	man	882,4	244,1	2,9	355,7	45,8	27,2
2015	SW	m. Tychy	wom	529,0	144,4	0,9	240,6	17,8	7,3
2015	SW	m. Zabrze	both	668,9	178,3	0,6	225,1	25,2	11,3
2015	SW	m. Zabrze	man	838,3	212,9	0,7	268,8	37,6	15,9
2015	SW	m. Zabrze	wom	516,8	149,7	0,4	184,3	16,8	8,4
2015	SW	m. Żory	both	753,4	195,4	0,0	349,0	34,7	1,7
2015	SW	m. Żory	man	904,4	253,7	0,0	359,3	49,5	3,5
2015	SW	m. Żory	wom	599,8	144,5	0,0	318,1	20,4	0,0
2015	SW	mikołowski	both	869,8	265,8	1,5	307,6	26,7	14,1
2015	SW	mikołowski	man	418,3	118,1	1,1	153,3	12,8	7,4
2015	SW	mikołowski	wom	1079,7	309,5	0,0	474,6	38,8	20,4
2015	SW	myszkowski	both	1091,9	313,3	0,0	404,1	65,9	3,6
2015	SW	myszkowski	man	561,1	138,1	0,0	212,4	40,9	2,1
2015	SW	myszkowski	wom	939,9	310,7	0,0	386,9	43,4	3,0
2015	SW	pszczyński	both	728,4	217,6	0,0	253,8	56,5	2,5
2015	SW	pszczyński	man	385,8	110,0	0,0	135,6	22,1	1,9
2015	SW	pszczyński	wom	1151,5	306,7	0,0	536,1	117,3	0,0
2015	SW	raciborski	both	847,9	241,9	0,0	293,5	36,8	2,8
2015	SW	raciborski	man	394,2	100,2	0,0	139,5	18,9	1,0
2015	SW	raciborski	wom	911,8	260,5	0,0	443,1	34,4	6,2
2015	SW	rybnicki	both	856,8	241,1	0,0	308,2	27,5	3,5
2015	SW	rybnicki	man	453,5	113,9	0,0	166,3	10,5	2,8
2015	SW	rybnicki	wom	1110,8	325,3	0,0	464,8	61,4	7,5
2015	SW	tarnogórski	both	888,6	246,8	0,8	283,3	57,8	29,5
2015	SW	tarnogórski	man	420,8	101,0	0,0	137,3	31,8	13,6

ROK	REG	LAU1	Gender	SDR (EUpopSTD) per 100 thousand inhibitants					
				A00-Y98	C00-C97	C33-C34	I00-I99	J00-J99	J40-J47
2015	SW	tarnogórski	wom	890,8	276,7	1,5	361,7	47,3	30,2
2015	SW	wodzisławski	both	941,5	318,0	0,8	325,4	32,5	0,7
2015	SW	wodzisławski	man	458,4	144,0	0,7	159,8	18,3	0,4
2015	SW	wodzisławski	wom	1178,2	382,5	0,0	503,9	41,0	1,7
2015	SW	zawierciański	both	1196,9	326,4	0,0	441,3	48,5	3,5
2015	SW	zawierciański	man	603,8	153,2	0,0	212,4	25,8	1,9
2015	SW	zawierciański	wom	1033,0	323,9	0,0	487,9	44,9	4,9
2015	SW	żywiecki	both	779,6	222,3	0,0	316,0	39,1	1,5
2015	SW	żywiecki	man	467,0	120,8	0,0	186,0	29,8	0,8
2015	SW	żywiecki	wom	953,3	289,7	0,0	474,6	31,6	2,7
2015	ZSK	Bytča	both	881,2	241,6	41,2	380,9	69,3	27,7
2015	ZSK	Bytča	man	1231,7	348,1	63,9	478,3	124,0	44,8
2015	ZSK	Bytča	wom	622,2	168,4	25,2	313,0	31,0	13,1
2015	ZSK	Čadca	both	836,1	156,2	28,4	370,8	81,8	23,6
2015	ZSK	Čadca	man	1183,7	244,0	59,4	468,0	139,8	39,6
2015	ZSK	Čadca	wom	580,4	98,8	8,4	302,8	52,6	15,1
2015	ZSK	Dolný Kubín	both	666,1	201,3	30,2	288,7	36,2	7,0
2015	ZSK	Dolný Kubín	man	899,2	284,6	47,3	352,4	61,8	4,7
2015	ZSK	Dolný Kubín	wom	483,6	145,4	18,5	237,8	16,3	8,7
2015	ZSK	Kysucké Nové Mesto	both	885,1	231,7	24,2	396,6	83,5	20,4
2015	ZSK	Kysucké Nové Mesto	man	1201,7	270,9	40,9	525,7	175,5	60,4
2015	ZSK	Kysucké Nové Mesto	wom	644,2	196,2	9,8	289,1	35,6	3,5
2015	ZSK	Liptovský Mikuláš	both	703,0	167,8	33,4	313,6	66,6	8,6
2015	ZSK	Liptovský Mikuláš	man	948,1	250,6	62,8	350,3	110,2	23,0
2015	ZSK	Liptovský Mikuláš	wom	511,4	121,4	13,1	263,7	40,8	0,9
2015	ZSK	Martin	both	748,2	188,5	23,0	339,2	56,2	13,0
2015	ZSK	Martin	man	1022,9	262,1	38,9	440,5	74,1	18,9
2015	ZSK	Martin	wom	539,1	131,4	11,1	271,3	43,3	7,9
2015	ZSK	Námestovo	both	826,1	207,7	26,8	399,1	61,6	17,7
2015	ZSK	Námestovo	man	1211,0	339,5	47,8	567,9	71,2	17,5
2015	ZSK	Námestovo	wom	538,5	118,8	14,4	282,5	51,7	17,8
2015	ZSK	Ružomberok	both	850,6	198,2	25,9	387,8	69,1	22,0
2015	ZSK	Ružomberok	man	1173,4	279,9	41,1	479,2	114,0	40,4
2015	ZSK	Ružomberok	wom	616,7	149,0	12,0	309,6	44,7	13,9
2015	ZSK	Turčianske Teplice	both	881,7	225,8	42,9	389,7	100,5	11,6
2015	ZSK	Turčianske Teplice	man	1218,2	356,5	105,7	499,9	106,7	8,3
2015	ZSK	Turčianske Teplice	wom	616,2	120,1	0,0	318,4	88,5	16,7
2015	ZSK	Tvrdošín	both	805,7	218,6	34,0	336,1	83,2	25,1
2015	ZSK	Tvrdošín	man	1071,5	282,2	67,1	425,2	156,8	44,4
2015	ZSK	Tvrdošín	wom	581,1	165,9	8,9	252,1	41,8	16,2
2015	ZSK	Žilina	both	761,7	189,2	28,0	373,6	60,3	23,0
2015	ZSK	Žilina	man	1002,6	253,1	53,1	462,1	89,2	33,9
2015	ZSK	Žilina	wom	583,6	149,4	10,7	305,4	42,3	16,4

Source: Project AIR TRITIA, 2018