

# Topographical analyses of lung cancer incidence and mortality in Vojvodina

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## SUMMARY

**Background:** Lung cancer is the leading cancer among men in cancer incidence as well as in cancer death. More recently, unpublished data showed that in women, lung cancer is in the second place in both incidence and mortality in Vojvodina.

**Methods:** Data used for analyses were provided by Cancer Registry of Vojvodina, Oncology Institute of Vojvodina in Sremska Kamenica and from the Bureau of statistics. Descriptive epidemiological method was used. Data were analyzed topographically for two periods of observation, first from 1985 until 1995 and then from 1996 until 2005, separately for male and female population.

**Results:** During the period from 1996-2005, age standardized incidence rate in male patients higher than 140/100,000 was registered in 14 municipalities with the highest incidence of 188.8/100,000. In 40 out of 44 municipalities of Vojvodina, an increase in lung cancer incidence in male patients was registered. Mortality higher than 140/100,000 was registered in 4 municipalities; the highest mortality was 209.9/100,000. In 41 out of 44 municipalities of Vojvodina, an increase in lung cancer mortality in male patients was registered. During the period from 1996-2005, age standardized incidence rate in female patients higher than 20/100,000 was registered in 29 municipalities with the highest incidence of 37.0/100,000. In 39 out of 44 municipalities of Vojvodina, an increase in lung cancer incidence in female patients was registered. Mortality in female patients higher than 20/100,000 was registered in 19 municipalities with the highest mortality of 27.2/100,000. In 33 out of 44 municipalities of Vojvodina, an increase in lung cancer mortality in female patients was registered.

**Conclusion:** Vojvodina is a region with high lung cancer incidence and mortality rates. Incidence and mortality rates in male patients are higher according to topographical distribution than respective incidence in regions and municipalities in countries of the EU, while incidence and mortality rates in female patients are at the similar level as in the EU. In relation to results of the previous studies, we registered an important increase in lung cancer incidence and mortality rates in both male and female patients in the majority of municipalities of Vojvodina.

**Key words:** Lung Neoplasms; Epidemiology; Non MeSH: Vojvodina

## INTRODUCTION

There are differences in lung cancer incidence and mortality among developed countries. Lung cancer is leading cancer in male patients in the European Union (EU), while in female patients it is in the third place (1). Lung cancer in the United States of America (USA) is a leading cause of all cancer deaths in female, while the number of lung cancer deaths in male patients has been decreasing since 1996 (2, 3).

Lung cancer in Vojvodina is the leading cancer among men with malignant diseases as well as in cancer deaths in men. It is in the fifth place in women with malignant diseases and in the second place in cancer deaths in women in Vojvodina (4). More recent unpublished data show that lung cancer is in the second place among women with malignant diseases in Vojvodina. The same source of data pointed out that the age standardized incidence rate of lung cancer was 79.7 in male and 19.4 in female patients while the mortality was 67.6 and 14.2 respectively.

Our aim was to analyze epidemiological characteristics of lung cancer in Vojvodina topographically in the period from 1986 until 2005 by conducting analyses of lung cancer age standardized incidence and mortality rates in male and female patients by municipalities of Vojvodina in two separate periods.

## PATIENTS AND METHODS

Data used for analyses were provided by Cancer Registry of Vojvodina from the Oncology Institute of Vojvodina in Sremska Kamenica. Data comprehended the number of cases and deaths of lung cancer, by age groups in five-year intervals, for male and female population separately for the period from 1985 until 2005. Data from vital statistics from censuses in 1991 and 2002 were provided and used for calculations.

Descriptive epidemiological method was used. Data were analyzed topographically for two periods of observation, from 1985 until 1995 and from 1996 until 2005. Data were analyzed separately for male and female population.

Age standardized incidence and mortality rates were calculated for male and female population in each municipality of Vojvodina for two observed periods, based on crude incidence and mortality rates. Direct method of standardization was applied on standard population of Vojvodina according to censuses from 1991 and 2002.

## RESULTS

### Lung cancer incidence in male patients by municipalities of Vojvodina in the periods 1985-1995 and 1996-2005

During the period from 1985-1995, age standardized incidence rate in male patients higher than 140/100,000 was registered in 5 out of 44

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municipalities in central and northern part of the Province with the highest incidence of 151.9/100,000 in municipality of Srbobran. Incidence below 100/100,000 was registered in 14 municipalities in southern and western parts of the Province with the lowest incidence of 79.6/100,000 in municipality of Bač (Figure 1a).

During the following 10 years, in the period from 1996-2005, incidence higher than 140/100,000 was registered in 14 municipalities with the highest incidence of 188.8/100,000 in municipality of Vrbas. Incidence below 100/100,000 was registered in 2 municipalities only with the lowest incidence of 91.3/100,000 in municipality of Kovačica (Figure 1b).

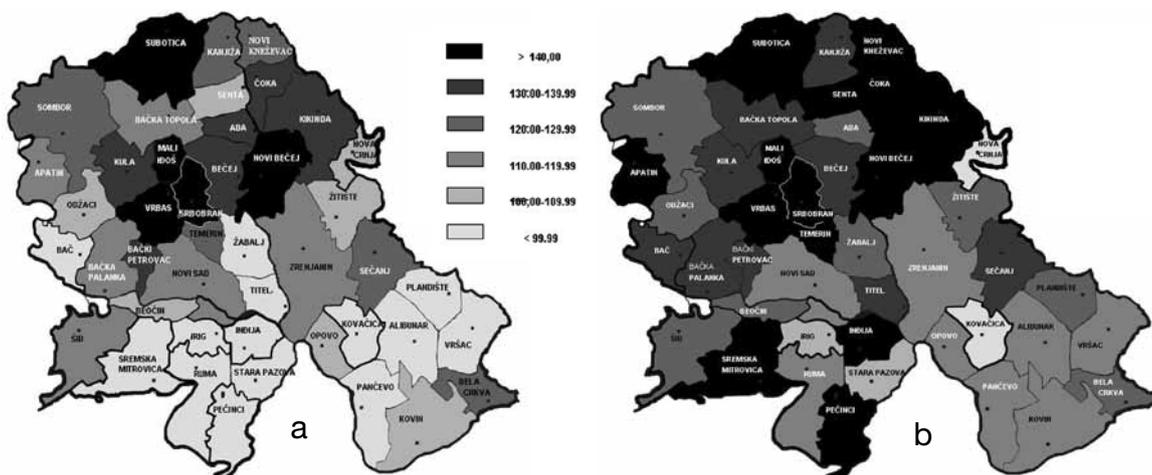


Figure 1. Age standardized incidence rates of lung cancer in male patients by municipalities of Vojvodina in the period a) 1985 -1995 and b) 1996 - 2005

During the second observed period in 40 out of 44 municipalities of Vojvodina, an increase in lung cancer incidence in male patients was registered. Incidence by municipalities grew from 0.8% to 76% by municipalities. Increase in incidence from 25% up to 50% was registered in 15 municipalities, an increase from 10% up to 25 % was registered in 17 municipalities, and an increase up to 10% was registered in 8 municipalities.

**Lung cancer mortality in male patients by municipalities of Vojvodina in the periods 1985-1995 and 1996-2005**

During the period from 1985-1995, age standardized mortality rate in male patients higher than 140/100,000 was registered in municipality of Mali Idoš in the central part of the Province with the highest mortality of 141.8/100,000. Mortality below 100/100,000 was registered in 25 municipalities predominantly in southern and western parts of the Province with the lowest mortality of 67.1/100,000 in the municipality of Pečinci (Figure 2a).

During the following 10 years, in the period from 1996-2005, mortality higher than 140/100,000 was registered in 4 municipalities with the

highest mortality of 209.9/100,000 in the municipality of Pečinci making it a municipality with the greatest increase in mortality of 212.7%. Remaining 3 municipalities are in the central part of the Province. Number of municipalities with mortality below 100/100,000 decreased to 10 predominantly in the southern part of the Province. Lowest mortality of 74.9/100,000 was also registered in municipality of Kovačica (Figure 2).

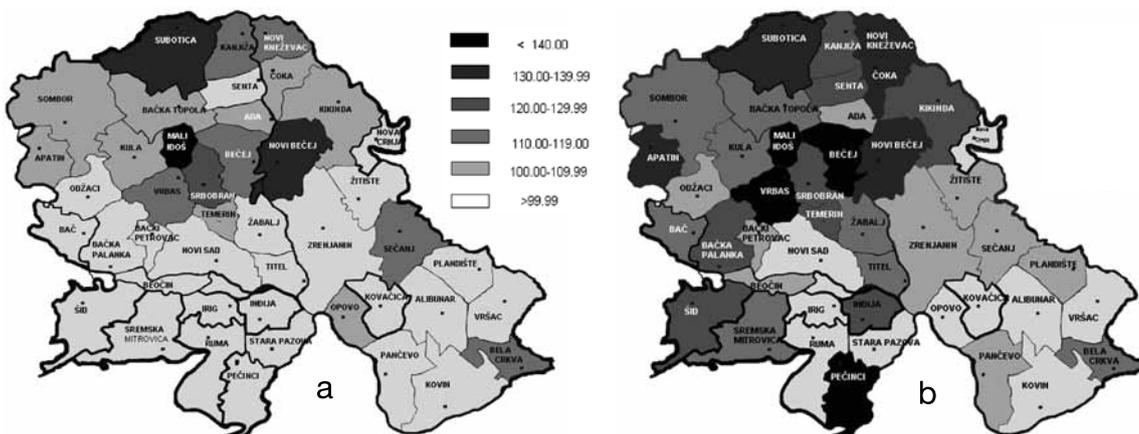


Figure 2. Age standardized incidence rates of lung cancer in male patients by municipalities of Vojvodina in the period a) 1985 -1995 and b) 1996 - 2005

Decrease in lung cancer incidence during the second observed period was registered in 4 municipalities ranging from 0.5% to 3.7%.

During the second observed period in 41 out of 44 municipalities of Vojvodina, an increase in lung cancer mortality in male patients was registered. Mortality by municipalities grew from 0.7% to 212.7%. Increase

in mortality for 25% up to 60 % was registered in 13 municipalities, an increase for 10% up to 25% was registered in 12 municipalities, and an increase up to 10 % was registered in 15 municipalities.

Decrease in lung cancer mortality during the second observed period was registered in 3 municipalities in the southern and eastern part of the Province for 5.5% to 16.4%.

**Lung cancer incidence in female patients by municipalities of Vojvodina in the periods 1985-1995 and 1996-2005**

During the period from 1985-1995, age standardized incidence rate in female patients higher than 20/100,000 was registered in 8 municipalities in central and southern part of the Province with the highest incidence of 27.6/100,000 in municipality of Ada. Incidence below 12/100,000 was registered in 5 municipalities, 4 in southern and western parts, and one in the north of the Province with the lowest incidence of 7.6/100,000 in municipality of Beočin (Figure 3a).

increase for 25% up to 49% was registered in 10 municipalities, increase for 10% up to 25% was registered in 7 municipalities, and an increase up to 10% was registered in 2 municipalities.

Decrease in lung cancer incidence during the second observed period was registered in 5 municipalities ranging from 13% to 28.3%.

**Lung cancer mortality in female patients by municipalities of Vojvodina in the periods 1985-1995 and 1996-2005**

During the period from 1985-1995, age standardized mortality rate in female patients higher than 20/100,000 was registered in 4 municipalities in central and southern part of the Province with the highest mortality of 151.9/100,000 in municipality of Nova Crnja. Mortality below 12/100,000 was registered in 14 municipalities in southern and western parts of the province with the lowest mortality of 5.1/100,000 in municipality of Beočin (Figure 4a).

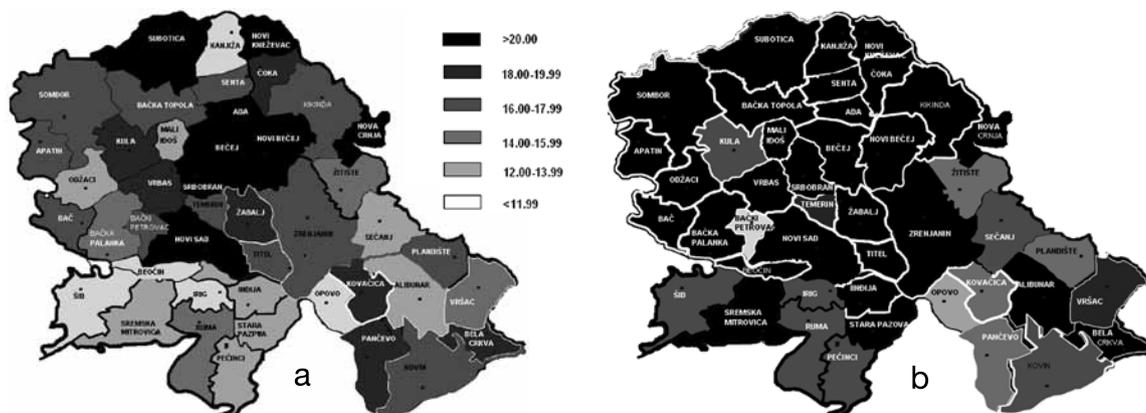


Figure 3. Age standardized incidence rates of lung cancer in female patients by municipalities of Vojvodina in the period a) 1985-1995 and b) 1996-2005

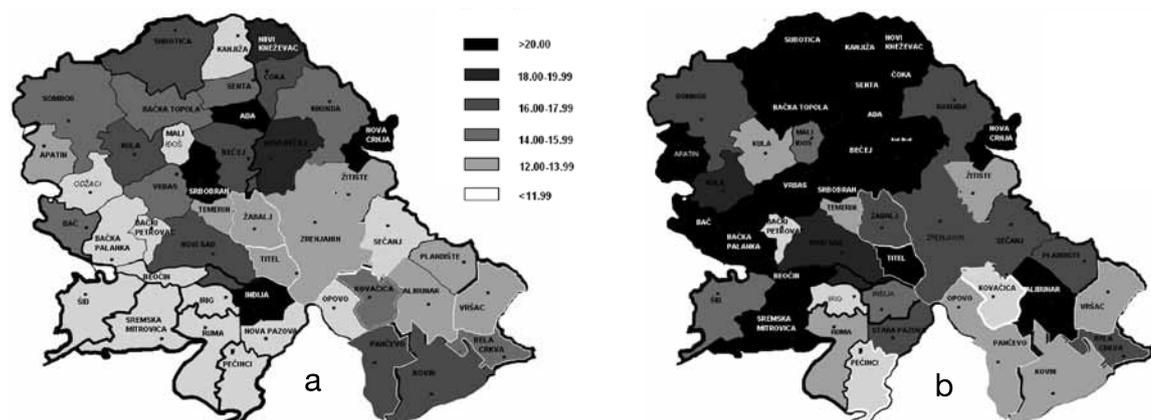


Chart 4. Age standardized mortality rates of lung cancer in female patients by municipalities of Vojvodina in the periods a) 1985-1995 and b) 1996-2005

During the following 10 years, in the period from 1996-2005, incidence higher than 20/100,000 was registered in 29 municipalities with the highest incidence of 37.0/100,000 in municipality of Vrbas. Incidence below 12/100,000 was registered only in the municipality of Bački Petrovac (Figure 3b).

During the second observed period in 39 out of 44 municipalities of Vojvodina, an increase in lung cancer incidence in female patients was registered. Incidence by municipalities grew from 0.2% to 310%. Increase in incidence for 50% up to 99% was registered in 17 municipalities, an

During the following 10 years, in the period from 1996-2005, mortality higher than 20/100,000 was registered in 19 municipalities with the highest mortality of 27.2/100,000 in municipality of Vrbas. Mortality below 100/100,000 was registered in 4 municipalities only with the lowest mortality of 8.1/100,000 in municipality of Pećinci (Figure 4b).

During the second observed period in 33 out of 44 municipalities of Vojvodina, an increase in lung cancer mortality in female patients was registered. Mortality by municipalities grew from 5.2% to 407.1%. Increase higher than 100% was

registered in 3 municipalities. Increase in mortality for 50% up to 99% was registered in 8 municipalities, an increase for 25% up to 49% was registered in 12 municipalities, increase for 10% up to 25% was registered in 6 municipalities, and an increase up to 10% was registered in 3 municipalities.

Decrease in lung cancer mortality during the second observed period was registered in 11 municipalities ranging from 2.4% to 46.4%. In the remaining 9 municipalities, a decrease in incidence for 12.6% to 26.8% was registered.

## DISCUSSION

There are substantial differences in incidence and mortality in the regions and populations within Europe. In men, incidence and mortality is the highest in Eastern Europe. In women, the highest incidence of lung cancer and mortality from lung cancer are almost two times higher in Northern than Western Europe. Estimates for the year 2000 indicate that the highest age-standardized rates in men are in Hungary, Croatia, Bosnia and Herzegovina, and Serbia with Montenegro. The lowest rates in Europe are found in Sweden, Iceland, Portugal, and Norway. In women, the highest rates are observed in Denmark, Iceland, Hungary, and UK. The lowest incidence rates in women are seen in Spain, Belarus, Malta, and Portugal.

In men, lung cancer mortality is declining in Northern and Western Europe, in countries such as the UK and Finland, although it is already low and fairly stable in Sweden and Norway. In Central and Eastern Europe, however, lung cancer mortality is increasing, although it has been thought since early 1990's that in Poland mortality rates are starting to level off. In women, there was high and increasing mortality in the UK until the end of the 1980's. Since then, however, a plateau has been reached and rates have started to decline. In Sweden and Norway, mortality has been increasing during the past 25 years, although it is still much lower than in the UK. In Southern Europe, mortality from lung cancer is both quite low and stable in countries like Greece, or increasing at a moderate rate, e.g., in Italy and Portugal (5). Predictions for the year 2010 show that, in the majority of EU countries (with exceptions of Spain, Greece, France, and Portugal) there will be a decline in mortality from lung cancer in men, but increase in women (6).

In our study, lung cancer incidence and mortality rates in men and women increased in the majority of municipalities during the second observed period. A change was more dramatic in women, especially, regarding the change in incidence.

Regarding the regions within countries of the EU, highest lung cancer incidence in male patients of 76.9/100,000 is registered in Poland in the region of Kielce (7). The lowest lung cancer incidence in a municipality in Vojvodina is higher than the incidence registered in Kielce.

In women, lung cancer incidence in majority of municipalities and regions is lower than 20/100,000 (7). In women in Vojvodina, lung cancer incidence is in the level of those registered in municipalities and regions in EU. Only regions in the UK registered incidence at higher levels (7).

According to the GLOBOCAN 2000 data, based on age standardized incidence rate, Yugoslavian (Serbia and Montenegro) male patients were in the third place among neighboring countries after Croatia and Bosnia and Herzegovina. Yugoslavian female patients were in the first place, by age standardized incidence rate, in front of Bosnia and Herzegovina and Albania. Based on age standardized mortality rate Yugoslavian male patients were in the sixth place and female patients were in the fifth place. The highest

age standardized mortality rate in male patients is in Croatia and in female patients in Slovenia (8).

Analyses in some neighboring countries like Bulgaria show that lung cancer incidence rate is expected to rise significantly until year 2017 (9). However, regarding the regions in Bulgaria highest lung cancer incidence in male patients in 2005 was registered in a district of Kurdjali reaching 69.2/100,000 and in female patients the highest incidence of 11.6/100,000 was registered in a district of Lovetch (10). These are much lower than respective lung cancer incidence rates in male and female patients registered by municipalities of Vojvodina during the second observed period in our study. Another observational study in female patients in Vojvodina indicated a significant increase in lung cancer trends in female patients in Vojvodina (11).

Decreases in lung cancer trends in male patients in developed countries are the result of intensive activities in prevention of smoking that started 20 years ago. They are a clear indicator of proper way to stop unfavorable trends. However, in female patients in developed countries there is a similar situation as in our study, presence of unfavorable increasing lung cancer trends.

## CONCLUSION

Vojvodina is a region with high lung cancer incidence and mortality rates. Incidence and mortality rates in male population are higher according to topographical distribution than respective incidence in regions, municipalities in countries of the EU while incidence, and mortality rates in female population are at the similar level as in the EU.

In relation to results of previous studies, we registered an important increase in lung cancer incidence and mortality rates both in male and female population in the majority of municipalities of Vojvodina.

Preventive measures, primarily measures directed to smoking cessation, in our population do not show good results yet. An aggressive smoking cessation campaign launched in Serbia in 2006 is expected to result in decline in lung cancer incidence and mortality rates in both men and women.

## Conflict of interest

We declare no conflicts of interest.

## REFERENCES

- 1 Esteve J, Kricke A, Ferlay J, Parkin DM. Facts and figures of cancer in the European community. Lyon: International Agency for Research on Cancer; 1993.
- 2 Baldini EH, Strauss GM. Women and lung cancer: waiting to exhale. *Chest*. 1997;112(4):229-34.
- 3 Greenlee RT, Murray T, Bolden S, Wingo PA. Cancer statistics 2000. *Ca Cancer J Clin*. 2000;50(1):7-33.
- 4 Petrović V, Miladinov-Mikov M, Mandić A. Lung cancer trends in Vojvodina. *J BUON*. 2006;11:49-53.
- 5 Tyczinski JE, Bray F, Parkin DM. Lung cancer in Europe in 2000: epidemiology, prevention and early detection. *Lancet Oncol*. 2003;4(1):45-55.
- 6 Bray F, Sankila R, Ferlay J, Parkin DM. Estimates of cancer incidence and mortality in Europe in 1995. *Eur J Cancer*. 2002;38:99-166.
- 7 Cancer Incidence in Five Continents. IACR; 2007. p. 9.
- 8 Globocan, IACR; 2000.
- 9 Hristova L, Dimova I, Ilcheva M. Projected cancer incidence rates in Bulgaria, 1968-2017. *Int J Epidemiol*. 1997;26(3):469-75.
- 10 Bulgarian National Cancer Registry. Cancer incidence in Bulgaria 2005. 2008. p. 16.
- 11 Miladinov-Mikov M, Žikić T. Lung cancer in female population of the Province of Vojvodina. The 22<sup>nd</sup> Annual Meeting of IACR. Khon Kaen; 2000. p. 62.