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Time trends in cancer mortality in Central Serbia

Submitted: 30 March, 2005
Accepted: 28 November, 2005

Summary

Objective: To examine cancer mortality trends in Central Serbia (1985–2002).
Methods: Cancer mortality rates were based on the official death certificates (n = 192849). They were standardized for age and sex.
Results: In the observed period, mortality rates showed a tendency to increase in both males (y = 118.54 + 2.27x, p = 0.0001) and females (y = 83.32 + 1.02x, p = 0.0001). Mortality of lung cancer increased in both sexes (y = 32.38 + 0.86x, p < 0.001 for males, y = 6.25 + 0.25y, p < 0.001 for females), as did colorectal cancer (y = 10.87 + 033x, p < 0.001 for males, y = 8.51 + 0.09x, p < 0.05 for females). Breast cancer mortality rates increased (y = 14.48 + 0.35x, p = 0.0001), and so did cervical cancer (y = 5.14 + 0.14x, p < 0.01). Mortality of gastric cancer in males has been moderately decreasing after 1990s ($y_{(1990–2002)}$ = 13.67–0.20x, p < 0.01), while prostate cancer mortality remained relatively stable.
Conclusions: Increasing cancer mortality trends in the last 18 years in Central Serbia indicate the extremely urgent needs for health authorities to adopt measures of cancer prevention that proved effective in other countries.

Keywords: Cancer – Mortality – Time trends.

Cancer, following cardiovascular diseases, is the second leading cause of morbidity and mortality in most developed countries (Shibuya et al. 2002). Although the risk of dying from cancer is still higher in the developed regions, more than 70 % of all cancer deaths occurred in low and middle-income countries (Mathers et al. 2001). In Serbia, the malignant tumours also were one of two leading causes of death in persons of 65 years or more during several decades (Institute of Public Health of Serbia 1998). In many developed countries, mortality rates of all cancer sites have shown a clear tendency to cease increasing, and some of them manifested decline. In Europe, trends in cancer mortality show a different pattern. While standardised mortality rates decrease in the European Union (Levi et al. 2002), these rates increase in Central and Eastern Europe (Antunes et al. 2002).

The aim of this survey was to examine the cancer mortality trends in Central Serbia in the period 1985–2002 with the emphasis on the most frequent malignant tumours.

The hypothesis was that socio-economic and political changes in our country during the last decade of the 20th century had an unfavourable impact on cancer mortality.

Material and methods

Central Serbia is a part of Serbia (without two provinces, Vojvodina and Kosovo), with about 5.5 million inhabitants.

The source of mortality data related to malignant tumours was the official death statistics (Federal Institute of Statistics, 1985–2002). Death certificates are issued and coded by trained medical doctors. Regional offices of Statistics compile information on death certificates. The Serbian Office of Statistics receives these data from each region and provides a unit record file of deaths with diagnosis, date of death, age, sex and place of residence as the most important variables.

Rates were calculated for the malignant tumours group (codes 140-208, according to the International Classification of Diseases (ICD), 9th edition and codes C00-C97, according to the 10th edition). In Serbia, the 10th edition came into use in 1997.

Population estimates were based on 1981, 1991 and 2002 census data and, for inter-census years, on the estimates published by the Federal Institute of Statistics in Serbia, which

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0303-8408/06/020117–6
DOI 10.1007/s00038-005-0023-7

take into account yearly births and deaths. Refugees, who as a result of the civil war came to Serbia from other parts of former Yugoslavia, were not counted as a part of the population when mortality rates were calculated. Using the direct method of standardization, the cancer mortality rates were age-adjusted for each sex on the standard world population (Jensen et al. 1991). Percentage changes of mortality age-adjusted rates were calculated as the percentage difference between the adjusted rates of two successive years, and as mean of changes for the observed period. The least square method was used to fit mortality rates to different trend curves (linear, logarithmic and S-model). Linear trend was used whenever it significantly ($p < 0.05$) represented estimated mortality rates.

Results

During the 18-year period analysed, 192 849 subjects died from cancer in Central Serbia (108 830 males, 84 019 females). The total number of cancer deaths increased from 8 130 in 1985 to 13 067 in 2002 (60.7 %). In Table 1, the number of cancer deaths, crude and standardised mortality rates from 1985 to 2002 are presented. The rates for all sites combined were higher for men than for women. Lower mortality rate for men in 1989 was due to decreased mortality from colorectal, prostate, oral cavity and pharynx, and liver cancers in this year.

In the observed period, mortality rates showed a tendency to increase in both males ($y = 118.54 + 2.27x$, $p = 0.0001$) and females ($y = 83.32 + 1.02x$, $p = 0.0001$). The mean percentage of annual changes was 1.62 % (95 % CI -0.42–3.66) in males and 1.05 % (95 % CI -0.43–2.54) in females.

Standardized mortality rates in Central Serbia in the year 2000 were similar to the rates in Bulgaria and Romania, but they were lower than rates in central European countries (Tab. 2).

The trends in age-adjusted mortality rates for the most frequent cancers are presented in Figures 1 and 2. Lung cancer had increasing mortality trends in both sexes.

Breast cancer was by far the leading site of cancer death in women. It increased significantly during the observed period. Cervical cancer also showed an increasing trend during the above mentioned period.

Mortality rates of colorectal cancer increased in both sexes. Mortality of gastric cancer in males has been moderately decreasing after 1990s, while prostate cancer mortality was relatively stable.

Discussion

The age-adjusted cancer mortality rates for men in Central Serbia in the observed period were similar to the rates in the neighbouring countries, but they were lower than the rates in

Table 1 Number of deaths, crude and standardized* mortality rates (per 100 000) of cancer by sex in Central Serbia, 1985–2002

	Males			Females		
Year	No.	Crude rate	Standardised rate	No.	Crude rate	Standardised rate
1985	4481	156.59	118.89	3649	124.76	82.66
1986	4420	154.04	115.45	3668	125.05	81.96
1987	4785	166.37	122.93	3929	133.62	87.12
1988	5313	184.27	134.22	4268	144.75	92.69
1989	5041	174.57	125.80	4220	142.83	90.07
1990	5612	194.17	136.52	4202	142.02	89.05
1991	5658	197.69	136.04	4303	145.87	88.44
1992	6083	212.97	144.88	4544	153.91	92.97
1993	6093	213.05	142.55	4581	155.12	92.51
1994	6146	215.02	140.99	4569	154.72	90.55
1995	6287	220.06	142.76	4907	166.22	95.77
1996	6488	227.34	143.75	4919	166.77	95.13
1997	6736	236.47	147.72	5052	171.52	95.87
1998	6874	241.90	149.33	5288	179.84	98.13
1999	6962	258.58	152.82	5349	188.85	100.11
2000	7206	268.90	156.76	5447	193.04	100.68
2001	7149	267.92	154.72	5553	197.52	101.34
2002	7496	281.70	156.54	5571	198.61	99.06

* world population

Table 2 Standardized* mortality rates (per 100 000) of cancer by sex and countries, 2000

Countries	Standardized mortality rates	
	Males	Females
Bulgaria	150.0	89.4
Romania	150.3	90.0
Hungary	272.3	147.4
Austria	168.6	113.8
Germany	176.6	116.9
Poland	205.2	111.4
Czech Republic	222.2	127.6
Central Serbia	156.8	100.7

*world population
(Source: *Ferlay et al.* 2001)

central European countries (Zatonski & Smans 1996; Levi et al. 1999). The standardised mortality rates in Central Serbia were lower in women than in men, and this fact had been noted in other countries as well. The mortality rates for female in Central Serbia were lower then corresponding rates in Hungary, the Czech Republic, Slovakia, Poland (Bray et al. 2002).

The increase of cancer mortality rates in Central Serbia in the initial part of the observed period may, at least partly, be accounted for by better diagnostics and reduction of symptoms and insufficiently defined conditions in all causes of death among which cancer victims might be found as well. Namely, these symptoms and conditions had a decreasing tendency from 19.3 % in 1975 to 7.0 % in 1991 (Jevremovic et al. 1994). However, this explanation for the increasing mortality trend can not be applied to the years after 1991. During the period 1992–2002, proportion of ill-defined causes among all causes of death maintained at the same level, and even slightly increased, achieving 8.7 % in 2000.

In general, changes in mortality rates can be due to changes in incidence rates and/or to changes in fatality rates.

The age-adjusted lung cancer mortality rates for males in Central Serbia were higher than corresponding rates in the European Union (EU) in 1998 except in the Netherlands and Belgium (La Vecchia et al. 2003). Moreover, while there has been a decreasing tendency of lung cancer mortality in EU countries, in Central Serbia mortality from this cancer showed a significantly increasing trend ($p < 0.01$) in both sexes. Taking into account that survival of lung cancer is poor even in developed countries, the increasing lung cancer mortality in Serbia can be explained with the increasing incidence of this malignant tumour, which is associated with the growing number of smokers of both sexes in our community. According to data for the Belgrade population, there were 49 % of male and 25 % of female smokers in the years 1976–1977, and there were 51 % male and 37 % female smokers in the years 1988–1989 (Vlajinac et al. 1990). Based on the recent assessment of health conditions and health needs of the population of Serbia, there were 56 % of male and 31 % of female smokers (Institute of Public Health of Serbia 2001).

The increasing tendency of breast cancer and cervical cancer mortality can be attributed to higher incidence, but also to the shorter length of survival as a consequence of unfavourable changes in health care during the 1990s. The changes in quality of health care have begun in 1991 with the war and breakdown of former Yugoslavia. The economic sanctions imposed on Serbia in 1992 and bombing in 1999 had a connection with low

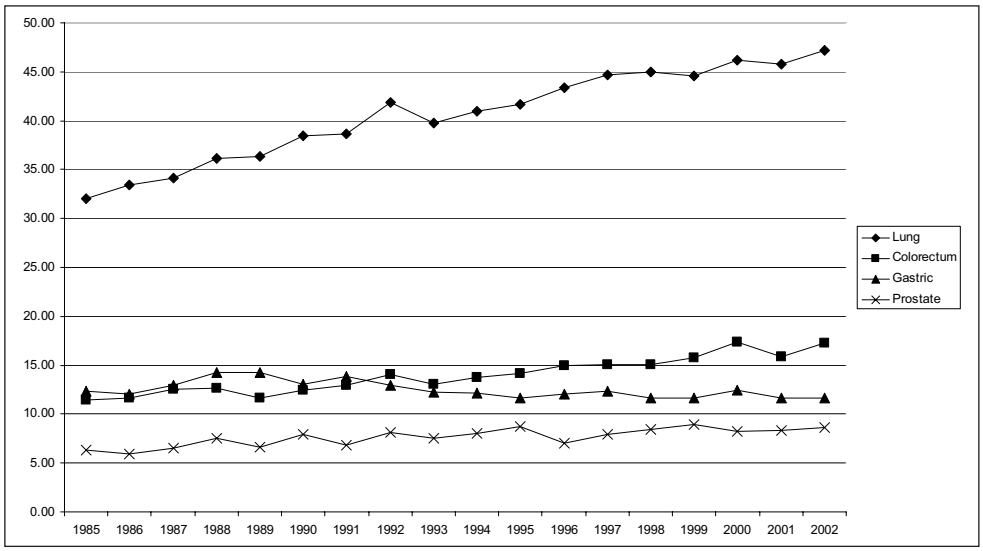

Figure 1 Age-adjusted mortality trends (1985–1999) for the most frequent cancer sites in males

Lung:
$y = 32.38 + 0.86x$; $p < 0.001$

Colorectum:
$y = 10.87 + 0.33x$; $p < 0.001$

Gastric:
$y_{(1985–1990)} = 11.59 + 0.34x$; $y_{(1990–2002)} = 13.67-0.20x$ $p < 0.01$

Prostate:
$y = 6.37 + 0.13x$ $p > 0.05$

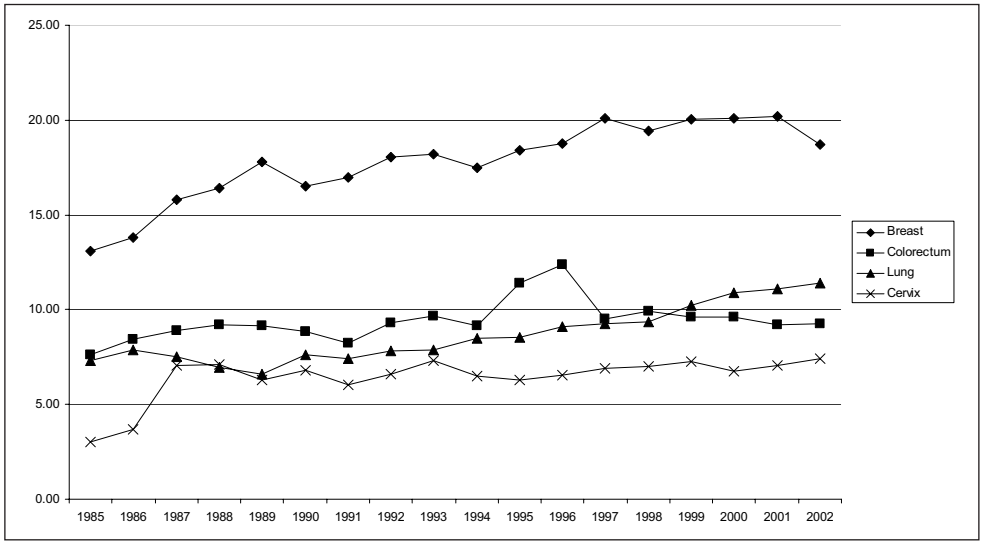

Figure 2 Age-adjusted mortality trends (1985–1999) for the most frequent cancer sites in females

Breast:
$y = 14.48 + 0.35x$; $p = 0.0001$

Colorectum:
$y = 8.51 + 0.09x$; $p < 0.05$

Lung:
$y = 6.25 + 0.25x$; $p < 0.001$

Cervix:
$y = 5.14 + 0.14x$; $p < 0.01$

quality of health service activities, outdated equipment for diagnostic and therapeutic procedures as well as numerous commercially unavailable drugs. Moreover, the problem was an excessively long period of time between the diagnosis of cancer and initiation of therapy in large medical centres, because of poor and uncoordinated communication between local and national hospitals. Higher mortality rates for breast and cervical cancers in Serbia, in comparison to EU countries (Ferlay et al. 1996), can be also explained with a higher incidence of these cancers in our population. In distinction from our country, decreasing trends in breast cancer and cervical cancer mortality has been reported in the EU after 1990, especially in younger female generations (Parkin et al. 1999). Decreasing morbidity and mortality especially from cervical cancer has been mainly seen in countries in which screening a programme was implemented (Quinn et al. 1999, van der Graaf et al. 1988).

Unlike the situation with most cancers, there was no big difference of colorectal cancer mortality between men and women. The mortality rates in Western European countries are declining, in contrast to the South and Eastern European countries, where the rates used to be lower but currently are increasing (Bray et al. 2002). In Central Serbia, the increasing tendency to colorectal cancer was probably due to altered nutrition habits of the population, poorer diagnostic, treatment and supportive care facilities. In 2000, within the overall cancer mortality in Central Serbia, colorectal cancer ranges second, just after lung cancer in men and breast cancer in women (Institute of Public Health of Serbia 2004).

In the observed period, only the gastric cancer mortality has been reported to decrease moderately, which is compatible with results obtained from other countries (Mathers et al. 2001). This decrease could be attributed to widespread use of refrigeration as a way of preserving food which reduces consumption of foods with a high content of salt and nitrates.

In distinction from developed countries where the mortality of prostate cancer has been reported to decline (Cookson 2001; Kwiatkowski et al. 2004), such trend has not been noted in Central Serbia.

The recently completed study of Burden of Disease and Injury in Serbia showed that the burden of cancer is dominated by premature mortality rather than by the length of disability (Vlajinac et al. 2003).

During the 1990s, about 600 000 refugees come to Serbia from different parts of former Yugoslavia. It is well known that cancer morbidity and mortality are higher in old age groups and that age structure and some other features of refugees can influence mortality trends. Since we had no exact data of demographic characteristics of refugees we decided not to include them in the estimation of cancer mortality.

Increasing cancer mortality trends during the last 18 years in Central Serbia indicate the extremely urgent need for health authorities to adopt measures of cancer control and prevention that proved effective in other countries.

Acknowledgement

This work was supported by the Ministry of Science and Ecology, Serbia, through contract No. 101927, 2002–2005.

Zusammenfassung

Krebsbedingte Sterblichkeitsraten in Zentralserbien (1985–2002)

Zielsetzung: Beurteilung der Mortalitätstendenz bei bösartigen Tumoren in Zentralserbien im Zeitraum vom 1985 bis 2002.

Methode: Die Sterblichkeitsziffern bei bösartigen Tumoren basieren auf amtlichen Erhebungen von Todesursachen (n = 192 849). Die Mortalitätsraten wurden nach Geschlecht standardisiert.

Ergebnisse: Während der Beobachtungszeit zeigen die Mortalitätsraten eine Zuwachstendenz sowohl bei Männern (y = 118.54 + 2.27x, p = 0.0001) als auch bei Frauen (y = 83.32 + 1.02x, p = 0.0001). Beide Geschlechter weisen einen Anstieg der Mortalität von Lungenkarzinomen auf (y = 32.38 + 0.86x, p < 0.001 für Männer; y = 6.25 + 0.25y, p < 0.001 für Frauen). Die Mortalitätsraten sowohl von Mamma- (y = 14.48 + 0.35x, p = 0.0001) als auch von Zervixkarzinomen (y = 5.14 + 0.14x, p < 0.01) zeigen einen statistisch signifikanten Zuwachs. Die Mortalitätsraten von Kolorektalkarzinomen weisen eine Zunahme für beide Geschlechter auf (y = 10.87 + 033x, p < 0.001 für Männer; y = 8.51 + 0.09x, p < 0.05 für Frauen). Die Mortalität von Magenkarzinomen zeigt nach 1990 eine leicht sinkende Tendenz, wobei die Mortalität bei Prostatakarzinom relativ stabil ist.

Schlussfolgerung: Die Zunahme der Mortalität bei Karzinomen während der Beobachtungszeit in Zentralserbien weist auf die dringende Notwendigkeit hin, dass die Gesundheitsbehörden entsprechende Porphylaxe- und Präventionsmaßnahmen treffen sollten, wie sie sich auch schon für andere Länder als nutzbringend erwiesen haben.

Résumé

Taux de mortalité du cancer en Serbie Centrale (1985–2002)

Objectifs: Examiner l'évolution (1985–2002) des taux de mortalité du cancer en Serbie Centrale.

Méthodes: Les taux de mortalité du cancer sont basés sur les certificats de décès officiels (n = 192 849). Les taux de mortalité ont été standardisés selon l'âge et le sexe.

Résultats: Les taux de mortalité du cancer sont en augmentation (1985–2002) chez les hommes (y = 118.54 + 2.27x, p = 0.0001) et chez les femmes (y = 83.32 + 1.02x, p = 0.0001). L'augmentation du taux de mortalité est statistiquement significative pour les deux sexes pour le cancer du poumon (y = 32.38 + 0.86x, p < 0.001, hommes ; y = 6.25 + 0.25y, p < 0.001, femmes) et pour le cancer colorectal (y = 10.87 + 033x, p < 0.001, hommes; y = 8.51 + 0.09x, p < 0.05, femmes). Chez les femmes, les taux de mortalité du cancer du sein (y = 14.48 + 0.35x, p = 0.0001) et du cancer du col de l'utérus (y = 5.14 + 0.14x, p < 0.01) sont en augmentation. Chez les hommes, les taux de mortalité du cancer de l'estomac diminuent depuis les années '90. Pour le cancer de la prostate, le taux de mortalité est relativement stable.

Conclusion: L'augmentation des taux de mortalité du cancer en Serbie Centrale souligne l'extrême importance, pour les autorités sanitaires, d'adopter des mesures de prévention du cancer qui se sont révélées efficaces dans d'autres pays.

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