Cancer Mortality in Central Serbia

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Summary

Purpose: Cancer is the one of the leading cause of death worldwide. The aim of this study was to examine cancer mortality trends in the population of central Serbia in the period from 2002 to 2011.

Methods: The descriptive epidemiological method was used. The mortality from all malignant tumors (code C00-C96 of the International Disease Classification) was registered. The source of mortality data was the published material of the Cancer Registry of Serbia. The source of population data was the census of 2002 and 2011 and the estimates for inter-census years. Non-standardized, age-adjusted and age-specific mortality rates were calculated. Age adjustment of mortality rates was performed by the direct method of standardization. Trend lines were estimated using linear regression.

Results: During 2002-2011, cancer caused about 20% of all deaths each year in central Serbia. More men (56.9%) than women (43.1%) died of cancer. The average mortality rate for men was 1.3 times higher compared to women. A significant trend of increase of the age-adjusted mortality rates was recorded both for males (p<0.001) and for females (p=0.02). Except gastric cancer, the age-adjusted mortality rates in men were significantly increased for lung cancer (p=0.002), colorectal cancer (p<0.05), prostate cancer (p=0.001) and pancreatic cancer (p=0.001). Age-adjusted mortality rates for breast cancer in females were remarkably increased (p=0.001), especially after 2007.

Conclusions: In central Serbia during the period from 2002 to 2011, there was an increasing trend in mortality rates due to cancers in both sexes. Cancer mortality in males was 1.3-fold higher compared to females.

Key words: cancer, mortality rate, trend

Introduction

Cancer is one of the leading cause of death worldwide. According to World Health Organization, during 2008, 7.6 million deaths were caused by malignant diseases, accounting for 13% of all lethal outcomes for that year [1]. In some highly developed countries, such as Japan, malignant tumors are the leading cause of death [2].

According to recently published data the European union (EU) countries, age-adjusted mortality rates of malignant tumors in 2007 were 153.7 per 100,000 population for males and 84.7 for females, and it has been expected that in 2013 it will be 140.1/100,000 for men and 85.3 / 100,000 for women [3].

The highest age-adjusted mortality rates for men have been reported in Hungary (255 /100,000), Czech Republic (216) and Poland (210), and the lowest in Spain (126), Finland (131) and Switzerland (137). The highest mortality rates for women were recorded in Denmark (141), Hungary (131) and Scotland (123), and the lowest in Spain (79), Greece (80) and Portugal (81) [4].

In the US, according to most recent available data for 2009, age-adjusted mortality rate was 173 per 100,000 population. This rate was lower by 20% in comparison to that recorded in 1991 (215), after which gradual decline of mortality rate followed in this country. It is expected that in 2013 the rate decline will be 1.8% annually for men and 1.5% for women [5].

The objective of this study was to estimate mortality rates of malignant tumors in the population in central Serbia in the period from 2002 to 2011.

Methods

The descriptive epidemiological method was used in this study. Mortality from all malignant tumors (code C00-C96 by the International Disease Classification) was registered in the population of central Serbia population in the period 2002-2011. Central Serbia encompasses the territory of Serbia without its northern and southern regions. Data on deaths were obtained from the Cancer Registry of the Public Health Institute of Serbia for the period 2002-2011. The 10th Revision of the International Classification of Diseases (ICD) was used. We analyzed all cancer deaths (codes C00-C97) and the 5 most frequent cancers in males and females.

The source of population was census of 2002 and 2011, and for the period in-between, data were obtained from the estimates published by the Republic Statistical Institute for inter-census years.

Statistics

Crude, age-adjusted and age-specific mortality rates were calculated. Age adjustment of mortality rates was performed by the direct method of standardization using the world population (Segy) as standard [6,7]. Linear regression was used for the analysis of mortality trens during the observed period. First, the least-squares method was used to estimate the linear trends presented in Figures. Then, correlation coefficients were calculated; a positive value indicated an increasing trend, while a negative value was indicative of a falling trend. A p-value <0.05 was considered significant. Data were processed using the Statistical Package for Social Sciences, v.17.0 (SPSS Inc., Chicago, IL, USA).

Results

During the observed period (2002-2011) 142,304 persons died from all types of malignant tumors in central Serbia. Of the total number of deaths from cancers, 80,917 (56.9%) occurred in males and 61,387 (43.1%) in females. The number of deaths as well as the crude mortality rates by sex in the observed period are presented in Table 1. The average mortality rate for men was 1.3 times higher compared to women. Age-adjusted mortality rates in central Serbia were higher for men than for women too (Figure 1). In the observed period, a significant trend of increase of the age-adjusted mortality rates was recorded both for males (y=157.1+1.44x; p<0.001) and for females (y=101.59+0.73x; p=0.02).

Age-adjusted mortality rates of the 5 most

Table 1. Number of deaths and crude mortality rates of cancer by sex, central Serbia 2002-2011

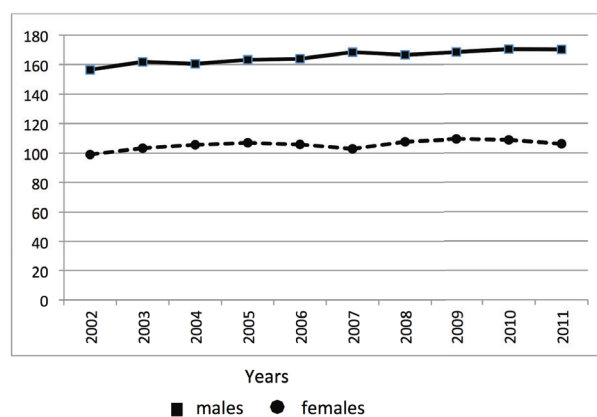| Year	Males		Females	
	No.	Crude rate	No.	Crude rate
2002	7496	281.7	5571	198.6
2003	7655	288.5	5832	208.5
2004	7728	291.9	5980	213.8
2005	7858	297.6	6142	219.6
2006	7968	302.8	6146	221.2
2007	8290	316.2	6083	219.7
2008	8278	316.9	6317	229.0
2009	8447	324.5	6536	237.7
2010	8605	331.7	6448	235.3
2011	8592	332.6	6332	232.0
Mean	8091.70	308.4	6138.70	242.4

Figure 1. Age-adjusted mortality rates (per 100,000) of cancer by sex, central Serbia 2002-2011. Standardization by world population.

common malignant tumors in men are presented in Figure 2. The average age-adjusted rate of lung cancer (47.0 per 100,000) was almost 3-fold higher than that of colorectal cancer (17.3). Except gastric cancer that showed moderate decline in the period 2002-2011 (y=11.6-0.16x), the age-adjusted mortality rates of other cancers were significantly increased: lung cancer (y=47.0+0.78x; p=0.002), colorectal cancer (y=17.0+0.13x; p<0.05), prostate cancer (y=8.6+0.39x; p=0.001) and pancreatic cancer (y=6.9+0.17x; p=0.001).

The average age-adjusted mortality rates for women were found 20.4 per 100,000 for breast cancer and 13.9 per 100,000 for lung cancer. The age-adjusted mortality rates for breast cancer were remarkably increased (y=10.9+0.56x; p=0.001), especially after 2007. Moreover, other age-adjusted mortality rates, except gastric cancer, were increased in the observed period (Figure 3).

With aging, the age-specific mortality rates of lung cancer showed an increasing trend in both genders, although the mortality in men after
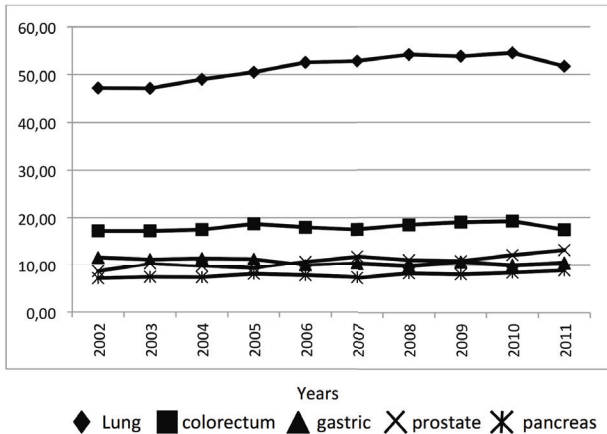
Figure 2. Age-adjusted mortality rates for the most frequent cancer sites in males, Central Serbia 2002-2011. Standardization by world population.
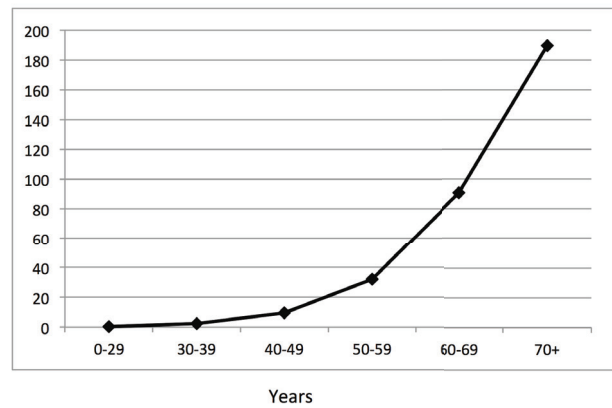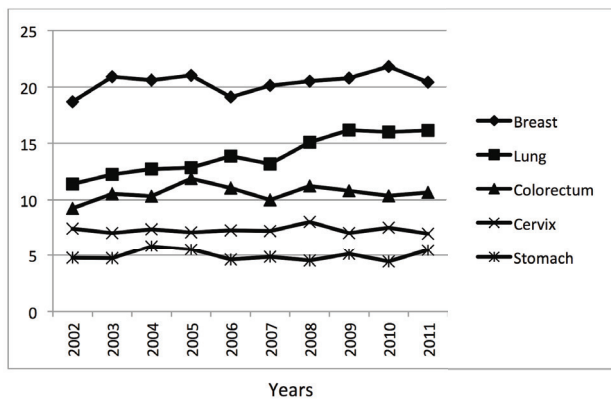

Figure 3. Age-adjusted mortality rates for the most frequent cancer sites in females, central Serbia 2002-2011. Standardization by world population.
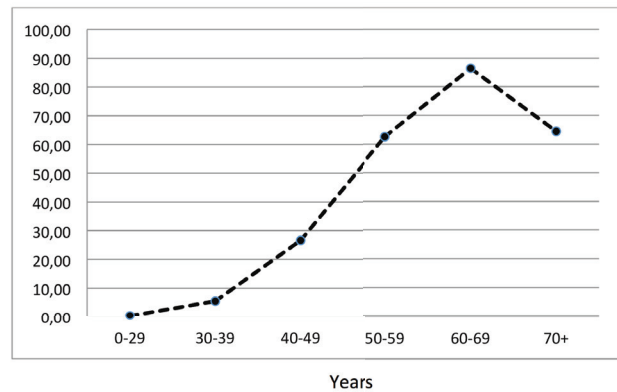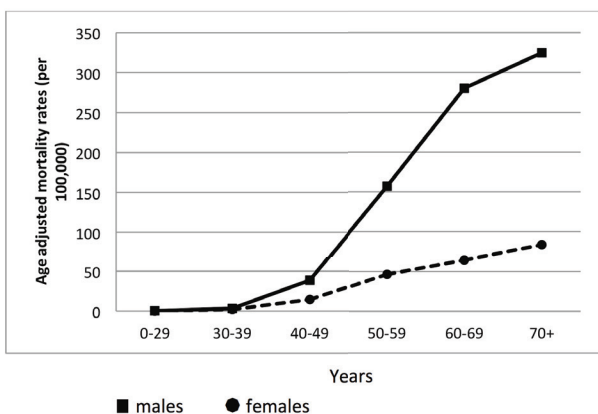

Figure 4. Average age-specific mortality rates for lung cancer in males and females, central Serbia 2002-2011.

50 years of age was considerably higher than in women (Figure 4). Age-specific mortality rates of colorectal cancer increased in older age groups. A remarkable rise was noted after the age of 60 (Figure 5).

Figure 5. Average age-specific mortality rates for colorectal cancer in males, central Serbia 2002-2011.

Figure 6. Average age-specific mortality rates for breast cancer in females, central Serbia 2002- 2011.

Figure 6 displays the age-specific mortality rates of breast cancer in women. The highest was seen in the 50 to 70 years age group (Figure 6).

Discussion

During the observed period (2002-2011), both crude and age-adjusted mortality rates of malignant tumors increased in the Central Serbia. In whole Serbia, in the period 1999-2009, the age-adjusted mortality rates for all malignant tumors increased from 130 to 143 per 100,000 inhabitants [8,9].

Similar trends have been recorded in neighboring countries. Age-adjusted rates in Romania were higher compared to Serbia, and in the period 1998-2008 they increased from 217 to 247 / 100,000 for men and from 126 to 130 for women [10]. In other Eastern European countries, different mortality rates for women have been reported. For men, standardized mortality rates were much higher in comparison with women, in all countries, except Cyprus [4,11]. Except Romania, in 2008, the age-adjusted mortality rates in central Serbia

(107/100.000), were higher than the rates recorded in Croatia (101), Slovenia (96), Bulgaria (88), Malta (80), Cyprus (63) and Turkey (56) [11]. An average age-adjusted rate for the period 2002-2011 was higher in Serbia than in all previously mentioned countries. The increase of cancer mortality rate in central Serbia recorded in the period 1991-2002, could be partially explained by better diagnostics, reduction of symptoms and ill-defined conditions within all causes of death, among which, cases dead of malignancy were also recorded [8]. This trend kept on increasing in the period included in our research. The observed increase of mortality in central Serbia in the last 10 years possibly implies problems in early diagnosis of malignant tumors, deficiency of screening programs, and consequently shorter survival rates. All the aforementioned suggest an urgent need of introduction of modern therapeutic modalities that may partially contribute to decrease of mortality, as well as population screening which allows for early disease diagnosis [11-14]. Although the basic plan of screening program organization was made 10 year ago [15], the National Program "Serbia against cancer" defined the baseline of mass screening of breast, cervical and colorectal cancer only few years ago. However, only opportunistic screening has been still implemented in our country.

Lung cancer ranks first in mortality rates and males, and second in women, after 2007. If, for the sake of comparison with other European countries, the average mortality rate of lung cancer in 2005-2009 was 52.8/100,000, it is noted that the rates were higher in Hungary (72.6/100,000), Poland (61.9), Croatia (57.6), Estonia (54.2) and Latvia (53.4) [16]. The average age-adjusted rate in the EU countries decreased by 8% in the period 2000-2004 and 2005-2009 (from 44.7/100,000 to 41.9%) [16]. This high mortality rate in central Serbia, which has been continuously increasing, contrasting the results from many countries with the reported decrease, may be explained by high prevalence of smokers. Namely, according to most recent published data in Serbia, 38% of males and 30 % of female smokers, while in the year 2000 it was 6.9% higher [17]. In women, the age-adjusted rates after 2007 were higher than mean rates in the EU (12.7/100,000). The high mortality rate of lung cancer in women suggests the need for more aggressive anti-smoking campaigns across the country.

In EU as a whole, the mortality rate of lung cancer tends to decrease, from (53.3/100,000) in the late 1980s, towards 44.0/100,000 in the early 2000s [4], while central Serbia reports increasing trends.

The gradual but continuous increase of mortality of breast and cervical cancer in women in central Serbia may be explained by the higher incidence rate and shorter survival due to inadequate healthcare caused by obsolete diagnostic and therapeutic equipment and problems with timely delivery of chemotherapy and radiotherapy. In addition, therapy doesn't start on time because of poor organization and communication between local health centres and tertiary-level hospitals, a fact that creates an important personal risk for the patients, coupled with irregular examinations. So far, there is only an opportunistic screening in our country. Introduction of a regular population screening program in our country should have a positive impact in lowering the incidence and mortality rates. Contrary to our country, in the EU countries the mortality rates of breast and cervical cancer are continuously decreasing, especially in countries which introduced population screening programs many years ago [18].

Unlike in previous years [6], the mortality of colorectal cancer in females in the observed period (2002-2011) ranked third, and in males second (no change). Mortality in Western European countries decreases, contrary to what is observed in Southern and Eastern European countries, where the rates are lower, but on the increase [19,20]. The increase of mortality rate of colorectal cancer in central Serbia may be, to some extent, explained by dietary habits, worse diagnostics, therapy and lack of adequate institutions for such patients.

The mortality rate of gastric cancer in men gradually decreases while in females it remains stable [19,21,22]. Contrary to these results, Japanese population is a typical example of continuous increase of mortality rates of gastric cancer in men. In the USA, Great Britain, Italy and France, the mortality rates of this cancer in the period 1950-2008 gradually decreased in both men and women [23].

Conclusion

In central Serbia, and for a 10-year period (2002-2011), the mortality rates of malignant tumors have increased in both genders. Lethal outcome in men is 1.3-fold higher compared to women.

Acknowledgements

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