MORTALITY CHARACTERISTICS
IN SUMADIJA DISTRICT FROM 2010 – 2017

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KARAKTERISTIKE MORTALITETA
U ŠUMADIJSKOM OKRUGU 2010-2017. GODINA

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ABSTRACT

Mortality rate represents a number of deaths on a particular territory per time unit. There are general and specific mortalities.

The aims at analysing the characteristics of mortality in Sumadija District for the time period ranging from 2010 – 2017.

The study includes all death cases in the District of Sumadija in period 2010-2017, 34681 cases. The data are described and analysed with χ^2 test and linear trend.

The trend analysis does not indicate any significant variations during the given time span. The gender analysis reveals that there is a significantly higher number of deceased persons among male population (52.2%, 47.8%, p<0.05). The average age of the deceased females (76.2±13.4) was higher than the average age of males (73.8±14.1) (p<0.05). The cause-specific analysis shows that natural causes of death dominate absolutely (96.5%) over violent deaths (2.7%) and undetermined causes (0.8%). The distribution of death causes according to ICD 10 shows that the most frequent causes of death are heart and blood vessel diseases, respiratory and neoplasm diseases.

The life expectancy of the inhabitants of Sumadija District is increasing over time. There was a slight decrease in the mortality rates during the observed time period. The highest number of the deceased people is 65 or more years old. Men have higher mortality rates throughout their lives. Natural death and non-communicable diseases are dominant. The most common causes of death are heart and blood vessels diseases, in women, and respiratory and neoplasm diseases, in men.

Keywords*: mortality, death causes, gender-specific mortality, Sumadija District*

SAŽETAK

Mortalitet predstavlja broj umrlih na određenoj teritoriji u određenom vremenskom periodu. Mortalitet može biti opšti i specifični.

Cilj istraživanja je analiza karakteristika smrtnosti u Šumadijskom okrugu u periodu od 2010 do 2017. Godine.

U studiji su uključene sve osobe preminule na teritoriji Šumadijskog okruga u periodu 2010-2017. Godina, njih 34681. Podaci su opisani deskriptivnim metodama i analizirani χ^2 testom i linearnim trendom.

Analiza trenda ne ukazuje na značajne varijacije broja umrlih u posmatranom periodu.

Analiza po polu ukazuje na statistički značajno veći broj preminulih osoba muškog pola (52.2% naspram 47.8%, r<0.05). Prosečna starost preminulih žena veća je u celom periodu analize (76.2±13.4) u poređenju sa preminulim osobama muškog pola (73.8±14.1) (p<0.05).

Analiza vrsta smrti pokazuje apsolutnu dominaciju prirodne smrti (96.5%) naspram nasilne (2.7%) i neodređenu (0.8%). Distribucija uzroka smrti prema MKB10 grupama bolesti pokazuje da su najčešći uzroci smrti: Bolesti srca i krvnih sudova, Bolesti respiratornog sistema i Neoplazme.

Životni vek stanovnika Šumadijskog okruga raste iz godine u godinu. Istovremeno, beleži se blago smanjenje stope mortaliteta u posmatranom periodu. Najveći broj preminulih čine osobe starosne dobi 65 i više godina. Muškarci imaju veću stopu smrtnosti tokom čitavog života. Prirodna smrt je dominantna vrsta smrti, a najčešći uzroci smrti su nezarazne bolesti. Najčešći uzrok smrti kod žena su bolesti srca i krvnih sudova, a kod muškaraca bolesti respiratornog sistema i neoplazme.

Ključne reči: *mortalitet, uzroci smrti, polno-specifični mortalitet, Šumadijski okrug .*

INTRODUCTION

Mortality rate represents a number of deaths on a particular territory per time unit (1, 2). In favourable circumstances, the curve which represents mortality rates has the shape of the letter "J" which indicates a low mortality during the initial years of life. This follows from biological factors so the curve has the similar shape for both sexes and all populations. However, a curve level is determined by a mortality rate of a given population which depends on external (exogenous) factors. Some of the most important external factors include life standard, health care development level, cultural characteristics, etc (3).

There are general and specific mortalities. General mortality is a demographic indicator of vital statistics which is, together with birth rate, used in the analysis of natural population growth. General mortality does not only depend on the intensity of dying, but also on age structures of populations. Populations with higher proportions of the elderly have a higher general mortality (4). Specific mortality represents mortality levels of a population relative to individual characteristics, such as sex, age, cause of death, etc.

Populations generally differ in terms of their age structures and consequently there are differences in general mortality rates. A method for comparing two or more populations is called standardization (5). Standardization can be direct and indirect. Direct standardization is used when morality rates of different age groups within observed populations are known. Global, i.e. European, population is used as standard population in such comparisons (2). Indirect standardization is used when mortality rates for age groups are not known for one population. In this case, the standardization is performed by using standardized mortality ratio.

The leading cause of death is an illness or injury that initiated a sequence of conditions that directly contributed to death or an accident or act of violence with deadly outcome. The International Classification of Diseases (10th revision) is used in the collection and processing of the data about death causes (6).

AIMS

This paper aims at analysing the characteristics of mortality in Sumadija District for the time period ranging from 2010 – 2017.

MATERIAL AND METHODS

The research is designed as a retrospective cohort study. The study includes all death cases in the District of Sumadija occurring from January the 1st, 2010 to December the 31st, 2017. The total number of deaths during the given time period equals 34681 cases.

As a data source, the study uses Death Certificates issued on the territory of Sumadija District. Death Certificates are filled in by an appointed doctor when death occurs in a medical institution or a coroner if death occurs elsewhere. Death certificates are distributed to the Center for biostatistics and computer science of the Institute for Public Health in Kragujevac where the data is entered into a specially designed access database.

The data needed for calculating the mortality rates are obtained from the *Health statistical yearbook of Republic of Serbia* published by The Institute of Public Health of Serbia "Dr Milan Jovanovic Batut" and the annual publications *Municipalities and regions of the Republic of Serbia* published by Statistical Office of the Republic of Serbia.

Statistical analysis

The data are first described by descriptive methods and then they are analysed with adequate methods of analytic statistics. Among descriptive methods, the study uses proportions, as an indicator of the structure for categorical data and measures of variability (mean values, standard deviation) for continual data. χ^2 test with contingency tables is used in examining the significance of the differences in categorical data frequency. Data standardization was made in relation to the standard population of Serbia. The results are presented in tables and charts. The data presentation contains p values with $p \leq 0.05$ considered as statistically significant. The data are processed with SPSS (Statistical Package for the Social Sciences) 21.0 computer program.

RESULTS

The number of deaths in Sumadija District during the selected time period equals 34,681. The trend analysis does not indicate any significant variations during the given time span. The gender analysis reveals that there is a significantly higher number of deceased persons among male population (52.2% against 47.8%, $p < 0.05$).

The analysis of the standardised general and gender-specific mortality shows a mild decrease in mortality over time (Chart 1). The analysis of the mortality with respect to age reveals that almost 80% of death cases were people who were 65 or more years old.

The life span of the Sumadian population has been increasing over time. The average age of the deceased was 72.8±14.2 in 2010 and 74.8±14.1 in 2017. The average age of the deceased females (76.2±13.4) was higher than the average age of males (73.8±14.1) ($p < 0.05$) throughout whole time period of observation.

The cause-specific analysis shows that natural causes of death dominate absolutely (96.5%) over violent deaths (2.7%) and undetermined causes (0.8%). Non-communicable diseases are the most frequent causes of death ($p < 0.05$). However, there is a mild upward trend in non-

communicable diseases as a death cause within male population (Table 1).

The distribution of death causes according to ICD 10 shows that the most frequent causes of death are heart and blood vessel diseases, respiratory and neoplasm diseases. The further analysis indicates that heart and blood vessel diseases are recently becoming more frequent as causes of death in female population while respiratory and neoplasm diseases are becoming more frequent with male population (Chart 2).

The leading causes of death during the given time period with respect to diagnoses were: Cardiomyopathia congestiva (I42.0, 23.6%), Insufficientia respiratoria, non specificata (J96.9, 5.3%), Neoplasma malignum bronchi et pulmonum, non specificatum (C34.9, 3.8%), Infarctus myocardii acutus, non specificatus (I21.9, 3.7%), Infarctus cerebri, non specificatus (I63.9, 2.9%), Hypertensio arterialis essentialis (primaria) (I10, 2.6%), Morbus pulmonum obstructivus chronicus, non specificatus (J44.9, 2.4%), Apoplexia cerebri ut haemorrhagia sive infarctus, non specificata (I64, 1.9%), Insufficientia cordis, non specificata (I50.9, 1.7%) and Morbus renalis chronicus, non specificatus (N18.9, 1.7%).

DISCUSSION

The examinations of mortality patterns have huge socio-medical significance and are important in improving public health conditions of a population. Based on the mortality patterns, countries can create their own health policies which would aim at improving health state of the population and prolonging the life span. However, the main goal is not to prolong life expectancy, but to prolong life time without diseases and incapability (7).

Mortality analyses most commonly use a transversal method of analysis (8). With this method, mortality is analysed in shorter time intervals (two, three years). The basic disadvantage of this method is a short time span. This analysis has overcome this disadvantage by prolonging the time period of observation.

The expected life length is calculated based on the mortality tables and it represents an average number of years a person of certain age may live, assuming an unchanged age-specific mortality from a year in which it is calculated. The study, which analyzed the life span of the populations of 15 developed countries over the last 20 years, reveals an increase in life expectancy (9). According to the data for the period 2010 – 2012, the average life expectancy in Serbia equalled 72.3 years for male population and 77.3 for female population. According to *Eurostata* data for 2012, among European countries the life expectancy of males was the highest in Iceland (81.6), and the lowest in Ukraine (66.1). Female population lived longest in Spain (85.4) and shortest in Moldova (74.9).

Vital statistics provides the data about deceased persons, not only with respect to age, but also to gender, na-

**Table 1.** Distribution of causes of natural death by type and sex, Sumadijski district, 2010-2016

Years	Non-communicable diseases		Infectious diseases	
	Men n (%)*	Women n (%)*	Men n (%)**	Women n (%)**
2010	2050 (49.7)	2076 (50.3)	4 (57.1)	3 (42.9)
2011	2095 (50.4)	2060 (49.6)	4 (50)	4 (50)
2012	2172 (50.6)	2123 (49.4)	1 (11.1)	8 (88.9)
2013	2073 (51.1)	1982 (48.9)	4 (57.1)	3 (42.9)
2014	2263 (53.3)	1977 (46.6)	4 (80)	1 (20)
2015	2186 (52.5)	1977 (47.5)	5 (83.3)	1 (16.7)
2016	2134 (51.9)	1981 (48.1)	2 (50)	2 (50)
2017	2200 (51.6)	2065 (48.4)	2 (100)	0

* - percentage representation of non-communicable diseases by gender for a given year
** - percentage representation of infectious diseases by gender for a given year
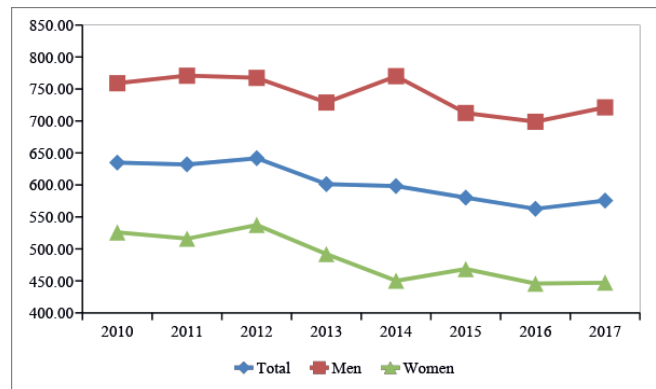
Graph 1. Standardized general and full specific mortality of the Sumadija district per 100,000 inhabitants per population of Serbia
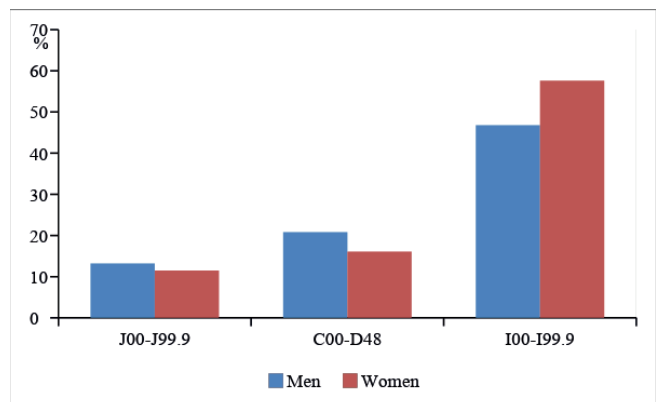
Graph 2. Comparative mortality in in men and women

tionality, educational level, occupation, marital status, etc. It can thus provide a detailed differential analysis of mortality. In Serbia, the general mortality levels were fluctuating from 1418.1 to 1428.6 from 2011 to 2016. During the same time period, there was a decreasing trend in standardised mortality in both Serbia and Sumadija District. In Sumadija, the values of standardised mortality

fell from 586.4 in 2011 to 539.3 in 2016 (in comparison to global population). Among the former Yugoslav republics, the general mortality rate is highest in Serbia, followed by Croatia, Montenegro, FYR of Macedonia, Slovenia and Bosnia and Herzegovina. Among the neighbouring countries, the most favourable general mortality rate is recorded in Albania (7.1‰), and the least favourable in Bulgaria (15.1‰). According to the 2014 data, Bulgaria has the highest mortality rate in Europe, followed by Ukraine (14.6) and Latvia (14.3%).

The mortality analysis with respect to age groups reveals that the highest number of deceased persons is aged 65 or more. In Sumadija District, mortality within the population of this age group went up from 77% in 2010 to 80% in 2017. In Europe, this share is 60%. The highest mortality with persons older than 65 is recorded in Moldova and Kazakhstan (10).

One of the main reasons for relatively high number of deaths in Serbia is unfavourable age structure of the population, i.e. intensive population ageing. Based on the 2011 consensus, the average age of the Serbian population was 42.2 years with an ageing index of 1.25. In Sumadija District, the ratio of the elderly (above 65) and the population aged 0 – 19 was 0.8. The boundary level is 0.4 which means that Serbian population can be classified as an old population (11). The mortality during the initial years of life is specially examined. Namely, the mortality of babies has been long considered as an indicator of socio-economic life circumstances, and today it is still one of the indicators of general development of some region. Mortality shows certain regularities in gender-specific mortality – males have higher mortality rates throughout whole life. The exceptions may sporadically occur with respect to certain categories, i.e. age groups, like with females in fertile life period.

Cause-specific analyses in the world show the absolute domination of natural causes of death. However, in certain countries the numbers of violent deaths may be high. In 2016, according to World Health Organisation, a half a million people died from violent causes (murders, wars, etc.) (12).

Cause-specific mortality and the development of International Classification of Diseases originates from the seventeenth century publication *Natural and Political Observations made upon the Bills of Mortality* by John Grant who tried to classify and describe death causes with children aged 0 – 6 based on the available death reports. Today, in developed countries, there is a trend of grouping death causes into several leading non-communicable diseases. In 2016, among 56.9 million of the deceased in the world, 54% died from "The top 10 causes of death". The most common causes depend on socioeconomic development, so they vary among the countries. In developed countries, noncommunicable diseases dominate, including ischemic heart disease, stroke, dementia, neoplasms. In Europe, 80% of deaths are caused by non-communicable diseases, which are responsible for the death of every third person under the age of 65 (13). In underdeveloped countries, there is a slight change in the trends of death causes – there is still an absolute dominance of infectious diseases but there is also a mild increase in non-communicable diseases. The most common causes of death are: respiratory system infection, diarrhea, stroke, ischemic heart disease and HIV infection (14).

The most common causes of death in Serbia are circulatory system disorders, neoplasm, respiratory system diseases and injuries and poisoning (78.9% of deaths). A comparison between 2010 and 2016 shows that there is an upward trend in the number of deaths due to neoplasm and diseases of respiratory system from 20.9% to 21.8% and from 4% to 4.8% (respectively). At the same time, there is a downward trend in the number of deaths from circulatory system diseases (from 54.7% to 51.7%) and injuries and poisoning (from 3.3% to 2.8%).

CONSLUSION

The life expectancy of the inhabitants of Sumadija District is increasing over time.

In Sumadija District there was a slight decrease in the mortality rates during the observed time period.

The highest number of the deceased people is 65 or more years old.

Men have higher mortality rates throughout their lives.

Natural death is dominant and the most common causes of death are non-communicable diseases.

The most common causes of death are heart and blood vessels diseases, in women, and respiratory and neoplasm diseases, in men.

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