

## MORTALITY FROM CEREBROVASCULAR DISEASES AT THE TERRITORY OF DOLJEVAC MUNICIPALITY

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The aim of the paper was to establish the basic descriptive epidemiological characteristics of the subjects having died of cerebrovascular diseases at the territory of Doljevac Municipality. The data about the deceased were obtained after the population registration as well as by the physician on duty. The research included all of them who died of cerebrovascular diseases at the territory of Doljevac Municipality, in the period from 2002 to 2006. The descriptive epidemiological study was applied. Specific and general rates of mortality were being calculated, and the population data were obtained from the 2002 census. The rates were calculated per 100,000 residents. The total registered number was: 306 deceased, 180 females (59%) and 126 males (41%). Average annual specific rate of mortality based on cerebrovascular diseases was 311,2 per 100,000 residents (251,3 in men and 368,1 in women). Average annual rate of mortality in the population over 30 years of age in the same period was higher and reached 484,0 (389,7 in men and 577,2 in women). Women died 1.5 times more than men. The mortality rate was 1,3 times higher in the upland area of the municipality (349,3) than in the plain area (276,4). Cerebrovascular diseases-based death was reported in both sexes after 30 years of age. The youngest man was 32, and the youngest woman was 48. After 59 years of age, the death rate abruptly increased and reached the maximum after 70 years of age. The largest number of deceased women was reported in the age group 70-79 years, while the largest number of deceased men was noted in the age group 80-89 years. The lowest mortality rates in both sexes were registered in the 30-39 years age group (m/w rate - 44,9:16,3), and the highest in 80-89 years age group (m/w rate - 2138,7:1921,5). Almost 1/3 of the deceased was under 65 years of age. The mean age was 70.3 years in men and 76,1 years in women. In younger population under 65 years of age, the relation m/w 1:1.02 was insignificant. In the older population, the difference between the sexes was higher (m/w 1:1,5). The highest average annual mortality rate, related to education, was 479,3 in subjects with 8 years of education, 369,2 in those with 12 years of education, and 206,9 in those with 8-12 years of education. Marital status of the deceased in the younger population (under 65 years of age) was: 73% married, 13% divorced, 14% never married. In the older population (over 65 years of age), 42% married and 58 widowers. Average annual mortality rate according to marital status was the highest in the widowers (1534,7), in the divorced (800), and the lowest in those who never married (86,5) and married subjects (270,2). It is establish that younger married people get sick less than the elder ( $H_i=23,5$ ,  $p<0,001$ ). Among the deceased of older population, there were pensioners (58%), housewives (25%), and agriculturalists (13%). Among the younger population, there were workers (36%), agriculturalists (31%), housewives (18%) and unemployed (10%). The highest number of the deceased is in summer (June and August) and winter period (November, December), mostly in the forenoon or afternoon hours. Annual rates of mortality from cerebrovascular diseases show slow but continuous increase. *Acta Medica Medianae* 2008;47(1): 27-31.

**Key words:** cerebrovascular diseases, death confirmation, epidemiology, mortality

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### Introduction

In Serbia, diseases of brain blood vessels are the first individual cause of death in women and second in men, right after ischemic heart disease. In our country, every 15 minutes one individual dies of insult and every 18 minutes of infarction. Among the leading causes of death from the

circulatory system diseases, cerebrovascular diseases have 29% of share. Death rate, apart from sex, increased in the last two and a half decades for about 38%. In our country, when compared to Europe, a medium high risk of death from cerebrovascular diseases is reported (1,2,3,4).

In the structure of mortality in 2002, among 10 leading diseases in the world, cerebrovascular diseases took the second place with 9.3% of share, right after ischemic heart disease (12,3%). It is estimated that it will have been the leading cause of death in the world by 2020. According to combined indicator of premature death and DALY incapability, cerebrovascular diseases together with heart this our part of the world (5,6).

## Aims

The aim was to establish the basic epidemiological characteristics of death from brain blood vessels diseases (sex and age, residence, marital status, education, profession, seasons), at the territory of Doljevac Municipality.

## Material and methods

The paper presented descriptive epidemiological method of work. The data about the deceased subjects having died of cerebrovascular diseases in Doljevac Municipality, in the period from 2002-2006, were obtained from the death confirmations issued by death-confirmation service and physician on duty. General and specific mortality rate were calculated, and the population data were obtained from 2002 census. The rates were calculated per 100,000 residents.

## Results

In the period from 2002-2006, at the territory of Doljevac Municipality, 306 subjects died of brain blood vessels diseases, out of which 126 (41%) were of male and 180 (59%) of female sex. Average annual specific mortality rate was 311,2 per 100,000 residents (251,4 in men and 376,2 in women).

In the population over 30 years of age, in the same period, specific mortality rate was higher and reached 484,0 (389,7 in men and 577,2 in women).

Table 1 shows the number of the deceased of cerebrovascular diseases during the observation period, mortality rates in general population as well as in the population over 30 years of age.

Table 1. The number of subjects having died of cerebrovascular diseases, and mortality rates at the territory of Doljevac Municipality in the period from 2002-2006

Year	Number of the deceased	1/100000	
		Rate (0-75+)	Rate (30+)
2002	58	296.1	458.6
2003	66	337.1	521.8
2004	52	266.2	411.1
2005	62	317.2	490.2
2006	68	343.2	529.7
Total	306	311.9*	482.2**

\* average annual mortality rate in general population

\*\* average annual specific mortality rate in population over 30 years of age

The lowest mortality rates in general population and population over 30 years of age were noted in 2004 (in general population 266,3, in population over 30 years of age 411,1).

Table 2 shows mortality rates by sex, at the territory of Doljevac Municipality.

Table 2. Mortality based on cerebrovascular diseases by sex, at the territory of Doljevac municipality, in the period from 2002-2006

Year	Men		Women	
	Number of deceased	1/100000	Number of deceased	1/100000
2002	24	239.5	34	356.4
2003	27	269.4	39	408.8
2004	21	209.5	31	324.9
2005	26	259.4	36	377.3
2006	28	279.4	40	419.2
Total	126	251.4*	180	376.2*

\* average annual mortality rates by sex

Average annual rate of mortality based on cerebrovascular diseases in men reached 251,4. The lowest rate was noted in 2004 (209,5), and the highest in 2006 (279,4). Average annual rate of mortality based on cerebrovascular diseases in women was 376,2. The lowest rate was reported in 2004 (324,9), and the highest in 2006 (419,2).

Out of the total number of subjects having died of cerebrovascular diseases, women presented with 59% and men with 41%. On average, women died 1,5 times more than men.

Specific rates of mortality based on cerebrovascular diseases are 1,3 times higher in upland area (349,3) than in plain area (276,4) of Doljevac Municipality.

Table 3. Mortality based on cerebrovascular diseases by sex and age, at the territory of Doljevac Municipality, in the period from 2002-2006

Age	1/100000					
	Total		Men		Women	
	No	Rate	No	Rate	No	Rate
30-39	8	30.6	6	44.9	2	16.3
40-49	16	60.5	10	70.4	6	50.7
50-59	24	97.6	12	89.2	12	106.1
60-69	41	149.7	16	121.1	25	178.6
70-79	102	539.5	30	375.3	72	704.2
80-89	86	1651.6	37	2138.7	49	1921.5
>90	29	666.6	15	750.1	14	583.3
Total	306	484.0*	126	389.7*	180	577.2*

\* average specific rates by sex and age

Table 3 shows the number of the deceased by sex and age, as well as mortality rates by sex and age at the territory of Doljevac Municipality, in the period from 2002-2006.

Dying of cerebrovascular diseases was registered in both sexes over 30 years of age. The youngest man was 32, and the youngest woman was 48. After 59 years of age, dying was highly increased and reached its maximum in subjects over 70 years of age. The lowest mortality rates, in both men and women, were registered in 30-

39 years of age group (30,6:16,3), and the highest in 80-89 years of age group (2138,7:1921,5).

Mortality rates under 49 and over 80 years of age were higher in men, and the mortality rates between 59 and 79 years of age were in women.

In the younger population, under 65 years of age, the ratio between sexes in total number of those who died of cerebrovascular diseases was insignificant m/w is 1:1,02. In the older population, the number of deceased women was higher; therefore, the difference between the sexes was higher, m/w relation is 1:1.6.

In the population of those who died of CVD, the subjects under 65 years of age presented with 29%, and the subjects over 65 years of age with 71%. On average, men died earlier (70,3 years of age), women died later (76,1 years of age).

Mortality rates in younger population were moderately high, while in older population they were very high and almost doubled after every 10 years of aging.

Linear trend of mortality of CVD was increased  $y = (289,7) \times (7,4)$ , that is, it increased for 7 deceased per 100,000 residents every year.

The number of the deceased in the period from 2002-2006 is presented in Chart 1. The highest number of the deceased was during the summer period (June, July and August) with 37% share, and during the winter period (November, December) with 24% share.

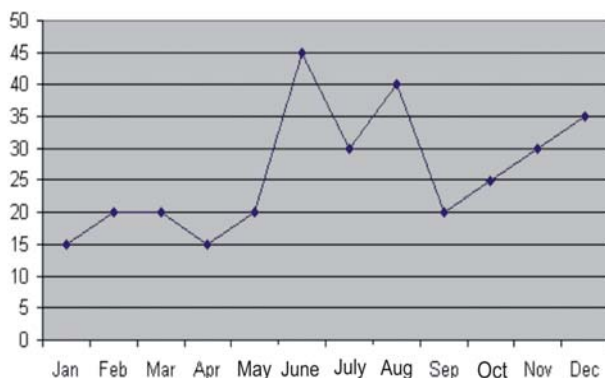
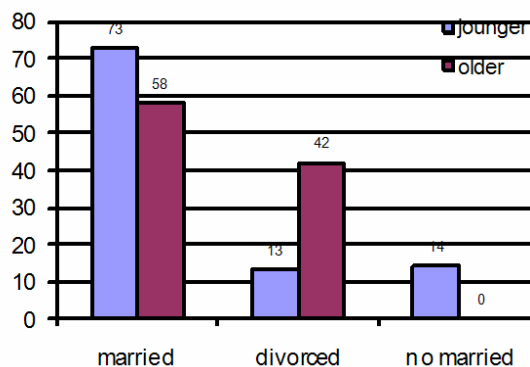


Chart 1. Number of the deceased over months, at the territory of Doljevac Municipality, in the period from 2002-2006

The highest percentage of the deceased included those subjects with less than 8 years of education (69%), 8-12 years of education (27%), and the lowest in those with over 12 years of education (4%). Average annual mortality rate according to education was the highest in the subjects with under 8 years of education (479,3), in those over 12 years of education (369,2). The lowest mortality rate was registered in the subjects with secondary education (8-12 years of education), and it reached 206,9.

Marital status of the deceased in the younger population (under 65 years of age): 73% married, 13% divorced, 14% never married. In the older population (over 65 years of age), 58% widowers and 42% married.



\*\*\* $p < 0.001$

Graph 2. Marital status of subjects who died during the observed period

Statistical analysis done by Mantel-Haenszel test showed a significantly higher frequency of married younger than older subjects ( $Hi = 23.5$ ,  $p < 0.001$ ) (Graph 2).

The highest average annual mortality rate according to marital status in the examined population was reported in widowers (1534,7), and divorced (800). The lowest mortality rate is registered in the subjects who never married (86,5), and in those who married once (270,2).

Among the deceased in the older population, there were mostly pensioners 58%, housewives 25%, agriculturalists 13%. By profession, the pensioners were: workers 29%, agriculturalists 32%, housewives 28%, others 11%. Among the younger population, there were workers 36%, agriculturalists 31%, housewives 18% and unemployed 10%.



Graph 3. Professions of subjects having died of brain stroke

Statistical analysis showed a high rate of workers among the younger population ( $Hi = 11,8$ ;  $p < 0.001$ ). Housewives were more frequent among the older population ( $Hi = 13,8$ ;  $p < 0,001$ ), the unemployed were more frequent among the younger population ( $Hi = 19,2$ ;  $p < 0,001$ ) (Graph 3).

Estimated annual mortality rate according to profession was the highest and almost equal in agriculturalists and housewives (916,9:913,2); a bit lower in the employed (892,4), and the lowest in the unemployed (52,9).

## Discussion

Average annual rate (311) of mortality based on cerebrovascular diseases at the territory of Doljevac Municipality is much higher than the mortality rate in Republic of Serbia (254) (2,3,4). Such high mortality rate is the consequence of: insufficient ability to recognize the risk factors, unhealthy way of living, inadequate nutrition, irregular control and occasional use of prescribed therapy, and bad socio-economic conditions.

According to the World Health Organization from the «Health for all» program from 2002, the rate of mortality based on cerebrovascular diseases in Europe was 137,5. The highest was in Ukraine (506), and the lowest in Switzerland (43) (6).

Out of the total number of the deceased in the observation period (306), there were 180 women (59%) and 126 men (41%).

According to the Zivkovic's research (2000), women in total morbidity and mortality, according to certain authors (Caplan et al., 1986), made 43% of the diseased, 62% died of brain stroke, which is also confirmed by this research (1).

The analysis of mortality by sex shows that general rates of mortality based on cerebrovascular diseases in the period from 2002-2006 at the territory of Doljevac Municipality are higher in women (376.2) than in men (251.4), while the total rate reaches 311.9. Higher mortality rates in women are registered in all the observed years. The cause is a larger number of deceased women in older age groups, as well as considerably larger portion of female than male population.

The analysis based on age shows that the number of the deceased and age-specific mortality rates increase with age, and more expressed increase is registered after 65 years of age (twice or more times higher). The highest age-specific rates of mortality in both sexes are registered in 80-89 years of age group (1651,6), and the lowest in 30-39 years of age group (30,6).

According to Hrbak-Zerjanovic's research (2001), death rates of cerebrovascular diseases, during aging, according to certain authors (Kutzke, 1985), have permanent logarithm increase; they are doubled per every 5 years of aging (7).

Age influence is absolutely logical, having in mind that with aging the state of blood vessels gets worse, the percentage of arteriosclerosis is higher, as well as of blood pressure.

Rates of mortality under 49 and over 80 years of age are higher in men, and the rates between 59 and 79 years of age are higher in women. Such mortality trend is directly associated with hypertension in both sexes, as well as postmenopause in women.

Mortality based on cerebrovascular diseases is the highest during the summer period (June, July and August) with 37% share, and in the winter period (November, December) with 24% share. Seasonal variations of cerebrovascular diseases are connected to extreme climate conditions effect (extremely high or low temperature effect).

Average annual mortality rates according to level of education are highest in subjects with lower level of education (under 8 years of

schooling), with high level of education (8-12 years of schooling), and lowest with secondary education (over 12 years of schooling).

This research also confirmed the research of Koster et al. (2005), according to which the subjects with the lowest level of education (under 12 years of schooling), with higher level of education (over 12 years of schooling) have the highest rate of mortality, and those with secondary education (12 years of schooling) have the lowest rate.

Koster's research, as well as this one, indicates that the subjects with the higher level of education have additional risk factors (probably at work place, in terms of increased responsibility) compared to the subjects with secondary and lower education (9).

Marital status of the deceased among younger population (under 65 years of age): mostly married subjects 73%, 13% widowers, 14% of those who never married. Among older population, 58% are widowers and 42% married. The characteristic of the younger population is a high rate of married people compared to older population.

According to marital status of the population in Doljevac Municipality and marital status of the deceased of cerebrovascular diseases, during the research period, it is noticed that the highest frequency of mortality appears in the group of widowers, divorced, and the lowest in the group of subjects who never married and those who are.

According to the research of mortality based on cerebrovascular diseases according to marital status in Australia in the period from 1969-1996, among younger population, the highest percentage belongs to the divorced, the subjects that never married, and the lowest to those who are married. Among the older population, the highest percentage belongs to widowers and the divorced (10).

According to profession, the analysis of the subjects who died of cerebrovascular diseases in younger population (population under 65 years of age capable of working) showed that the highest percentage includes the workers 36%, agriculturalists 31%, and housewives 18%. Among older population, pensioners present with 58%, housewives 25%, agriculturalists 13%. The analysis showed that the previous pensioners' professions were: worker 29%, agriculturalist 32%, housewife 28%, others 11%. The unemployed and workers are more frequent among the younger population and housewives among the older population.

According to researches in France and Spain, in the period from 1980-1982 and 1988-1990, among the population able to work, the highest number of those who died of cerebrovascular diseases in Spain were: physical workers, farmers, tradesmen, office workers; in France: workers, managers, farmers (11).

Hard labor, bad working conditions, permanent exposure to negative environmental influence, presence of stress, all that result in increased risk factors (hypertension, heart diseases, obesity etc.) for the occurrence of cerebrovascular diseases.

## Conclusion

Mortality based on cerebrovascular diseases in Doljevac Municipality in the period from 2002-2006 is much higher than in Serbia and developed

world countries. Dying trend of this disease was rising. Women die of this disease 1.5 times more than men, and the mortality is registered in both sexes over 30 years of age. The highest mortality rates are reported in the oldest age groups. Average age of the deceased men reached 70.3,

and of women 76,1. Dying of cerebrovascular diseases has seasonal character with characteristic dying in summer and winter months. The highest death rates are in the subjects with lower and higher level of education, in those without a spouse, in the subjects doing hard physical jobs.

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## MORTALITET OD CEREBROVASKULARNIH BOLESTI NA PODRUČJU OPŠTINE DOLJEVAC

Ivan Antić

Cilj rada bio je utvrđivanje osnovnih deskriptivnih epidemioloških karakteristika umrlih od cerebrovaskularnih bolesti sa teritorije opštine Doljevac. Podaci o umrlima dobijeni su iz potvrda o smrti izdatih od strane mrtvozoračke službe kao i od ordinirajućeg lekara. Istraživanjem su obuhvaćeni svi umrli od cerebrovaskularnih bolesti sa teritorije opštine Doljevac u periodu od 2002. do 2006. godine. Primenjena je deskriptivno epidemiološka studija. Izračunavane su specifične i opšte stope mortaliteta, a podaci o populaciji dobijeni su iz popisa 2002. godine. Stope su izračunavane na 100000 stanovnika. Ukupno je registrovano 306 umrlih, 180 žena (59%) i 126 muškaraca (41%). Prosečna godišnja specifična stopa mortaliteta od cerebrovaskularnih bolesti iznosila je 311,2 na 100000 stanovnika (251,3 kod muškaraca i 368,1 kod žena). Prosečna godišnja stopa mortaliteta u populaciji starijoj od 30 godina u istom periodu bila je viša i iznosila je 484,0 (389,7 kod muškaraca i 577,2 kod žena). Žene su u proseku 1,5 puta više umirale od muškaraca. Stopa mortaliteta veća je 1,3 puta u brdskom području opštine (349,3), nego u ravničarskom području (276,4). Umiranje od cerebrovaskularnih bolesti registrovano je kod oba pola posle 30. godine. Najmlađi muškarac imao je 32 godine, a najmlađa žena 48 godina. Nakon 59. godine umiranje se naglo povećava i dostiže maksimum kod starijih od 70 godina. Najveći broj umrlih žena je iz starosne grupe 70-79 godina, najveći broj umrlih muškaraca je starosne grupe 80-89 godina. Najmanje stope mortaliteta kod oba pola registrovane su u starosnoj grupi 30-39 godina (stopa m/ž 44,9:16,3), a najveće u starosnoj grupi 80-89 (stopa m/ž 2138,7:1921,5). Skoro 1/3 umrlih je mlađa od 65 godina starosti. Prosek godina umrlih muškaraca bio je 70,3 a žena 76,1. U mlađoj populaciji ispod 65 godina starosti odnos m/ž 1:1,02, je neznatan. U starijoj populaciji razlika među polovima je veća (odnos m/ž 1:1,5). Najveća prosečna godišnja stopa smrtnosti, sagledana prema obrazovanju, bila je kod osoba sa <8 godina obrazovanja (479,3), >12 godina obrazovanja (369,2), a najmanje sa 8-12 godina obrazovanja (206,9). Bračni status umrlih mlađe populacije (do 65 godina starosti): 73% osoba u braku, 13% razvedenih, 14% osoba koje nisu stupale u brak. U starijoj populaciji (iznad 65 godina), 42% osoba u braku i 58% udovaca. Prosečna godišnja stopa smrtnosti sagledana prema bračnom statusu najveća je kod udovaca (1534,7) kod razvedenih (800), a najmanja kod osoba koje nisu stupale u brak (86,5) i osoba u braku (270,2). Utvrđena je razlika u obolevanju osoba u braku, mlađe populacije, u odnosu na starije ( $H_i=23.5$ ,  $p<0,001$ ). Među umrlima u starijoj populaciji najviše je penzionera 58%, domaćica 25%, poljoprivrednika 13%. U mlađoj populaciji najviše je radnika 36%, poljoprivrednika 31%, domaćica 18% i nezaposlenih 10%. Najveći broj umrlih je u letnjem periodu (jun i avgust) i zimskom periodu (novembar, decembar) a vreme nastupanja su najčešće prepodnevi i podnevni sati. Godišnje stope mortaliteta od cerebrovaskularnih bolesti pokazuju blagi ali kontinuirani porast. *Acta Medica Medianae 2008;47(1):27-31.*

**Ključne reči:** cerebrovaskularne bolesti, potvrda o smrti, epidemiologija, mortalitet