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MORTALITY TRENDS IN THE REPUBLIC OF SRPSKA IN THE 21ST CENTURY (2001-2022)

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Abstract

Negative demographic trends in Republic of Srpska (negative natural increase, negative migration balance, aging) have an increasingly significant impact on the socio-economic development Republic of Srpska. At the beginning of the 21st century, the long-term decrease in the number of births and increase in the number of deaths were recognized as destabilizing factors of demographic development. The intensification of population emigration to EU countries and other countries of the world (USA; Canada, Australia) is of particular concern. Mortality in Republika Srpska was influenced by various socio-economic, demographic and epidemiological factors. The main goal of this paper is to analyze the changes in mortality indicators within the framework of contemporary trends in population movements in the Republic of Srpska. The results of the research show that certain changes (positive and negative) related to mortality were recorded in the Republic of Srpska (increase in life expectancy at birth, decrease in infant mortality, and some trends that are not favorable, especially those related to the causes of mortality. Although there was until the decrease in the share of deaths from some diseases, a significant increase in the number of deaths from certain diseases (Covid-19) was recorded, which can attributed to an unhealthy lifestyle and various behavioral factors.

Key words: Mortality, mortality by cause, life expectancy at birth.

Introduction

Mortality is a negative component of population change in the overall movement, and its level is the result of a complex interaction of health and economic factors. On the other hand, mortality affects the age and gender composition, as well as the socio-economic composition of the population (Wertheimer-Baletić, 1999). The countries of the world invest great efforts in improving the health of their population. These efforts are aimed at reducing mortality and improving the health status of the population. During the 20th century, in developed countries, the increase in real income was accompanied by an unprecedented decrease in mortality rates, resulting in an increase in life expectancy at birth by almost thirty years (Cutler et al., 2006). The population of countries with low mortality rates is

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in the late phase of demographic and "epidemiological" transition. Given that these countries have previously recorded strong declines in infant mortality rates, future mortality trends will largely depend on adult mortality, especially in the old and oldest populations.

The theory of epidemiological transition, which was devised by (Omran, 2005), is based on the theory of demographic transition, requiring a more detailed analysis of the causes of population mortality.

Analyzes and forecasts of mortality trends are particularly important for researchers from numerous scientific disciplines, decision makers, insurance companies and others, as they provide essential information for making relevant decisions. Based on this information, decision-makers can adequately (re)direct financial resources and implement important institutional changes related to the pension system and health care, in accordance with the real prospects for the survival of certain cohorts of the population.

Methodological research framework

In this research, data on trends in the general mortality rate, specific mortality by age and sex, causes of mortality, mortality caused by the disease COVID-19, infant mortality and life expectancy at birth for the period 2001 to 2022 were analyzed. In such circumstances, demographic analysts calculate certain indicators, which is also done in this paper. It is about the so-called the basic equation, that is, the balance equation and the comparative vital statistics method. Also, the research is based on the application of the methodological procedure of factor and cluster analysis, and the methodological model "sustendemo" for the study of demodynamics.

The quantitative-dynamic model of population changes (for overpopulation) is obtained according to the formula: $r= (\sqrt{2}-1). 1000$ and $r = (\sqrt{0.5}-1). 1000$ for depopulation. At the end of the eighties of the last century, Bosnia and Herzegovina entered a specific phase of its demographic development. The pattern of population renewal changed (below the level for simple reproduction), and then there were war events, which particularly affected demographic trends.

Demographic analysis refers to the analysis of the results, which assesses the reliability of the solution, that is, the achieved goal (Pašalić et al., 2020). Visualization of statistical data was done on the basis of values obtained using statistical methods and illustrated in the form of maps, which more clearly show certain regularities (connections or relationships) in the data than can be seen on the basis of tabulated series of data. Grouping analysis is a multivariate statistical method intended to classify individual observation units (objects) into a certain number of groups (clusters), based on identified similarities and/or differences in terms of the values of selected variables.

Results of research and analysis

Since the beginning of the 20th century, the number of deaths in Bosnia and Herzegovina has decreased and reached its lowest level in the second half of the

20th century (from the 1960s to the beginning of the 1990s. After the war in Bosnia and Herzegovina (1992-1995), the number of deaths began to increase). According to the theory of epidemiological transition, the decrease in mortality can be attributed to the changing relationship between socio-economic development, changes in lifestyle and innovations in medicine in different periods.

Table 1. Number of deaths in the Republic of Srpska 2001-2022.

Year	Average. population	Native	Died	Adj. acc.	General stop.mort.
2001.	1.248,655	13.699	13.434	265	10,76
2002.	1.194.178	12.336	12.980	-644	10,87
2003.	1.192.622	10.537	12.988	-2.451	10,89
2004.	1.190.526	10.628	13.082	-2.454	10,99
2005.	1.187.940	10.322	13.802	-3.480	11,62
2006.	1.185.145	10.524	13.232	-2.708	11,16
2007.	1.182.217	10.110	14.146	-4.036	11,96
2008.	1.179.717	10.198	13.501	-3.303	11,44
2009.	1.177.995	10.603	13.775	-3.172	11,69
2010.	1.176.419	10.147	13.517	-3.370	11,49
2011.	1.174.420	9.561	13.658	-4.097	11,63
2012.	1.173.131	9.978	13.796	-3.818	11,76
2013.	1.170.342	9.510	13.978	-4.468	11,94
2014.	1.167.082	9.335	14.409	-5.074	12,35
2015.	1.162.164	9.357	15.059	-5.702	12,96
2016.	1.157.516	9.452	13.970	-4.518	12,07
2017.	1.153.017	9.339	14.663	-5.324	12,72
2018.	1.147.902	9.568	14.763	-5.195	12,86
2019	1.142.495	9.274	15.081	-5.807	13,20
2020.	1.136.274	9.161	16.582	-7.421	14,59
2021.	1.128.309	9.274	19.002	-9.728	16,84
2022.	1.120.236	9.118	16.263	-7.145	14,52
Total:	**-**	**222.031**	**315.681**	**-93.650**	**-**

Source: Statistical bulletins 2001-2023, RZSRS, Banja Luka, 2023.

In the observed period (2001-2022), the number of deaths recorded an increasing trend, and after the Kovid-19 pandemic, when due to the pandemic, there was a significant increase in the number of deaths and the mortality rate in 2020 and 2021. The average annual number of deaths in the analyzed period (2001-2022) was 16,218.6, while in 2021 it reached a record 19,002 deaths. Therefore, there are two years in which there was a greater increase in the number of deaths (2020, 2021). During 2020, 16,582 died, and during 2021, that number is 19,002. This increase was not only recorded in Republic of Srpska or Bosnia and Herzegovina, but also in other European countries (for example, in Serbia and Croatia). Such a strong increase in mortality is associated with the Covid-19 pandemic, which significantly affected mortality, especially during the second and fourth waves. The mortality rate in the unknown period also increased not only due to the

increase in the number of deaths, but also due to the simultaneous decrease in the population in Republic of Srpska and Bosnia and Herzegovina. Namely, in these two periods (2001-2022, and 2020-2021), the number of inhabitants in the Republic of Srpska decreased by nearly 28% compared to the number from 1991 (Pašalić, 2023). Regression analysis with the help of junction points showed that there is one junction point in the trend of mortality rates, which means that two periods are distinguished in the trend, the first period from 2001-2013, and the second period from 2014-2022.

An increase in mortality was recorded in the second period as a result of several factors. In that period, there was a decrease in the number of the population, especially due to more intensive emigration of the population, and in addition, in this period, the baby boom generation born after the Second World War entered an age where the risk of mortality is significantly higher, especially mortality from infectious diseases such as flu or Covid-19.

Specific mortality according to age and gender during the 20th century, which continued in the 21st century, there was a shift in the age of the elderly.

Table 2. Died by age and gender in 2021

Gender	Total	%	<1	1-19	20-34	35-49	50-64	65+
Total	19.002	100,0	17	26	104	495	2.760	15.600
Male	9.943	52,33	10	21	75	353	1.920	7.564
Female	9.059	47,67	7	5	29	142	840	8.036

Source: Statistical bulletins 2022, RZSRS, Banja Luka, 2023.

The results of the analysis point to significant changes in the distribution of deaths according to age groups. In almost all age groups, the proportion of deaths increased compared to 2020, although both years recorded increased mortality as a result of Covid-19. Male mortality is slightly higher than female mortality in the overall balance. In the youngest age group 1-19, mortality is expected to be the lowest (1.37%0), while it is the highest in the 65+ contingent (82.10‰). The more mature age contingents had a lower mortality than the older contingent and a slightly higher mortality rate than the youngest contingent. Therefore, the above data point to the transition of mortality to older age, especially among the oldest population, which is in accordance with the theory of epidemiological transition, i.e. the assumption that degenerative chronic diseases (which especially affect the elderly population) become the most important cause of death, and the assumption related to the increase survival rates of children up to 15 years of age. In this context, it is important to emphasize the influence of the baby boom generation, which after 2010 began to enter old age and thus contributed to the mortality transition.

Infant mortality - it is considered one of the main indicators of health status and one of the most important measures of life expectancy (Wang, 2002). It is related to socio-economic conditions that affect the health of mothers and children. Today, infant and toddler mortality is lower than ever. During the 20th century,

advances in medicine and public health in Western industrialized countries resulted in significant reductions in infant mortality rates.

In the Republic of Srpska (that is, Bosnia and Herzegovina) in the middle of the last century, up to 1/3 of infants died before reaching one year of age. However, in the first decades of the 21st century, there was a significant decrease in infant mortality. Rates have continued to decline all these years (with some deviations in certain years). At the beginning of the analyzed period, the rate was 5.33%0, while at the end of 2022 it decreased to 1.86%0. In addition, infant mortality in Republic of Srpska has been lower than the EU-27 average in recent years (3.3‰).

Table 3. Infant mortality in the Republic of Srpska

Year	Total	Male	Female	Death rate
2001.	73	41	32	5,33
2019.	15	7	8	1,62
2020.	43	21	22	4,69
2021.	17	10	7	1,83
2022.	40	28	12	1,86

Source: Statistical bulletins 2022, RZSRS, Banja Luka, 2023.

Infant mortality is mostly recorded in the neonatal period (between 0 and 7 days of life), after which the survival rate increases. Republic of Srpska has a high survival rate of children under the age of five (99.81%), which means that it has already reached the UN goal of sustainable development (2.5% in all countries by 2030).

Mortality by cause of death - where the International Classification of Diseases (ICD) is used worldwide and provides important information on the prevalence of certain diseases, their causes and consequences, and mortality.

Standardized categories and data collection for MKV enable extensive research and form the basis for comparative analyzes of causes of mortality and morbidity among different locations over time. Considering the period analyzed in this paper, a revised version of MKV (ie MKV-10) was used. As in other industrialized countries, in the Republic of Srpska, the most important cause of death is non-communicable diseases, especially cardiovascular and neoplasms.

The main cause of death during the analyzed period was diseases of the circulatory system, but mortality per 100,000 inhabitants decreased in the total population and in both sexes, especially in men. The mortality rate from diseases of the circulatory system was higher in women than in men.

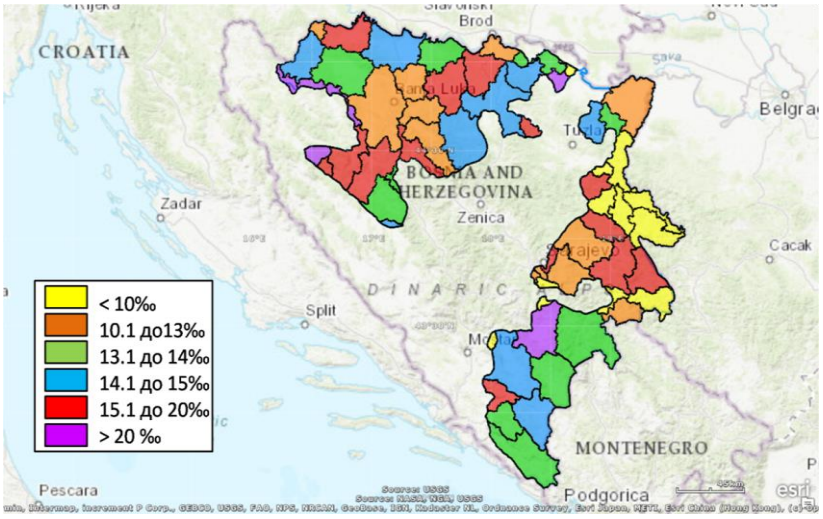
Table 4. Mortality according to causes of death

Causes of death	Total	Male	Female	Death rate
100-199 diseases of the circulatory system.	7.217	3.261	3.956	6,40
U00-485 codes for special names.	3.846	2.213	1.633	3,41
S00-D48 neoplasms	2.623	1.558	1.065	2,32
R00-R99 symptoms, clinical findings	2.213	1.187	1.026	1,96
E00-E88 glands, dig., ner.syst.	2.134	1.100	1.034	1,89
Other diseases	969	624	345	0,86
Total:	**19.002**	**9.943**	**9.059**	**16,84**

Source: Statistical bulletins 2022, RZSRS, Banja Luka, 2023.

The analysis of mortality according to the causes of death points to two prevailing trends, a decrease in mortality from cardiovascular diseases and an increase in mortality from neoplasms and endocrine diseases, diseases of nutrition and metabolism. Certain reductions in the causes of death from certain diseases are the result of preventive achievements in medicine, preventive examinations, improvements in diagnostics, drugs and advances in the technology of treating cardiovascular diseases. At the same time, the death rate from neoplasms increased, the number of deaths from cancer and the share of the total number of deaths decreased at the end of the observed period, which is the result of the introduction of a program of preventive examinations, early detection of the disease, and increasingly effective treatment.

Figure 1. Mortality rates of municipalities and cities of the Republic of Srpska



Source: Author's creation in GIS technology, based on data from "Cities and Municipalities" of the Republic of Srpska, Republic Institute of Statistics of the Republic of Srpska, Banja Luka, 2022.

Mortality from Covid-19 - the first case of infection with the SARS-CoV-2 virus (coronavirus) was recorded at the beginning of 2020, and by the end of December 2021, 120,370 cases of infection with the virus were recorded, and 6,594 deaths. The pandemic had a significant impact on socio-economic and demographic processes, but the most obvious impact was on mortality, especially the second and fourth waves of the epidemic (November and December 2020 and 2021). The impact of COVID-19 on mortality is best reflected by analyzing excess mortality. If the monthly number of deaths in 2020 and 2021 is compared with the average monthly number of deaths in the five-year period before the pandemic (2015-2019), increased mortality can be noticed, especially in November and December. In the same months of 2021, the excess mortality was 21.05%.

What is "excess mortality"? It is the ratio of the number of deaths that were expected in a certain period to the number of deaths that occurred in that period. How is "excess mortality" calculated? It is calculated by taking the number of deaths in a country or area where the corona virus reigns, minus the average number of deaths in the same period that was recorded, for example, a few years before the corona virus, then minus the official number of deaths from the corona in the same period, which gives "excess mortality" in that country or area.

Republic of Srpska: total number of deaths in 2021 19,002, average number of deaths in the past 5 years (2015-2019) 15,001. From the total number of deaths in 2021, the average number of deaths (2015-2019) and the number of deaths from the corona virus are subtracted. "Excess mortality" in 2021: 19,002 – 15,001 – 4,001 = 4,001 (Pašalić, 2022).

The situation with Covid-19 in Bosnia and Herzegovina and Republic of Srpska led to various lockdowns, and it also affected migration movements.

According to the data of the Republic Institute for Statistics of the Republic of Srpska (RZSRS), 19,002 people died in 2021, while 16,582 people died in 2020. Compared to the average number of deaths in the period 2015-2019. year (five-year average), which amounts to 15,001 deaths per year, in 2021, 4,001 more people died than that average (26.67%), while in 2020, 1,581 people died more than the stated average (10.54%). This is an "excess mortality" of 5,582 people.

Table 5. Births and deaths in the Republic of Srpska

Year	Native	Died	Arr.Arr.	Excess death.
2020.	9.161	16.582	- 7.421	1.581
2021.	9.274	19.002	- 9.728	4.001

Source: Statistical Bulletin 2021, RZSRS, Banja Luka, 2022.

Analyzing the above data, several factors are pointed out, one of the key factors being Covid-19, direct mortality, but also the indirect "excess mortality" that occurs in the circumstances of the pandemic.

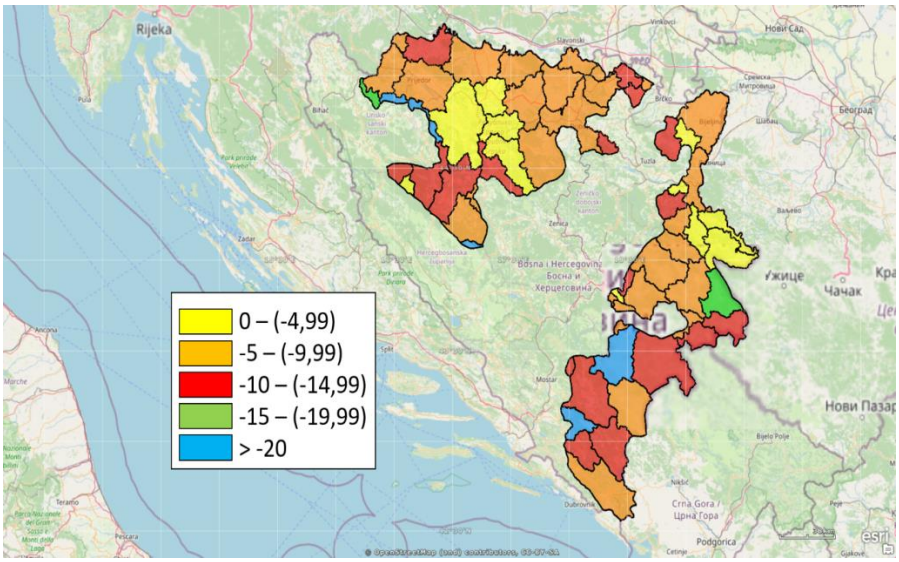
However, that is not all, since these negative factors also coincided with the departure of the so-called the "baby boom" generation, but also some other

demographic factors that are not completely new in the Republic of Srpska and Bosnia and Herzegovina.

Life expectancy at birth is another important indicator of mortality in a certain population and is closely related to the standard of living in health conditions. Differences in health status are conditioned by differences in the population transitions of individual countries, so there is a close correlation of life expectancy at birth, the level of economic development and growth in recent times (Top, Cinaroglu, 2021). A key mechanism important for increasing life expectancy is the epidemiological transition.

All over the world, including in Republic of Srpska and BiH, women live longer on average than men. Research related to the causes of men's shorter life expectancy emphasizes the role of biological factors (eg lifestyle habits and more often they adopt risky behavior patterns, which is reflected in their increased mortality). Thus, according to (Oeppen and Vaupel, 2002), in the last two centuries in numerous developed countries, life expectancy has more than doubled, from 30-40 years, to about 80 years and more.

Figure 2. Natural increase of municipalities and cities of Republika Srpska in 2022.



Source: Author's creation based on data from the Bulletin - births and deaths in the Republic of Srpska 2022, Republic Statistical Office, Republic of Srpska, Banja Luka, 2023.

The increase in life expectancy at birth in Republika Srpska began in the 20th century and continued in the 21st century. In 1950, the life expectancy in Bosnia and Herzegovina was quite low (about 55 years for men and 60 years for women), compared to industrialized Western countries, which has since significantly increased by about 10 years. Until the end of the 20th century, the increase in life

expectancy was slower and more uniform, and increased more for women than for men.

Conclusion

In the last two decades in Republic of Srpska, certain changes (positive and negative) related to population mortality indicators have been recorded. Population aging and intensive depopulation resulted in an increase in mortality rates, especially at the end of the researched and studied period (2001-2022), when the Covid-19 pandemic had an additional negative impact on mortality. However, mortality has shifted to older age due to the increasing entry of the baby boom generation into old age and due to the increasing survival rates in younger and adulthood. Positive trends were recorded in infant mortality rates and life expectancy at birth. Despite the recorded positive trends, the mentioned indicators are still below the EU-27 average. On the other hand, the general mortality rate continuously increased and was above the EU-27 average throughout the analyzed period. Significant changes were also recorded in mortality according to the cause of death. Although there was a decrease in mortality from diseases of the circulatory system, there was an obvious increase in mortality rates caused by neoplasms, endocrine diseases, diseases of nutrition and metabolism, especially in women. The Covid-19 pandemic also significantly affected mortality in the Republic of Srpska, as the annual number of deaths increased, "excess mortality" was recorded compared to the previous period, and life expectancy at birth decreased. The recorded diversification of the causes of death increases the pressure on the health system and has a stronger impact on the distribution of health resources. Therefore, further analysis of mortality according to the cause of death, and according to age and sex, is needed in order to determine the impact of certain diseases on potentially lost years of life and on life expectancy at birth and in old age. In addition, the mentioned results should serve as a basis for designing and implementing preventive programs aimed at mitigating the most significant public health challenges.

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TRENDOVI SMRTNOSTI U REPUBLICI SRPSKOJ U 21. VEKU (2001.-2022.)

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Apstrakt

Negativni demografski trendovi u Republici Srpskoj (negativan prirodni priraštaj, negativan migracioni saldo, starenje) sve značajnije utiču na društveno-ekonomski razvoj Republike Srpske. Početkom 21. veka dugogodišnji pad broja rođenih i porast broja umrlih prepoznati su kao destabilizujući fakori demografskog razvoja. Posebno zabrinjava intenziviranje iseljavanja stanovništva u zemlje EU i druge zemlje svijeta (SAD; Kanada, Australija). Na smrtnost u Republici Srpskoj uticali su različiti socioekonomski, demografski i epidemiološki čimbenici. Osnovni cilj ovog rada je analiza promena pokazatelja mortaliteta u okviru savremenih trendova kretanja stanovništva u Republici Srpskoj. Rezultati istraživanja pokazuju da su u Republici Srpskoj zabeležene određene promene (pozitivne i negativne) vezane za mortalitet (povećanje očekivanog trajanja života pri rođenju, smanjenje mortaliteta dojenčadi, te neki trendovi koji nisu povoljni, posebno oni koji se odnose na uzroke smrtnosti. Iako je do sada došlo do pada udela umrlih od nekih bolesti, beleži se značajan porast broja umrlih od određenih bolesti (Covid-19), što se može pripisati nezdravom načinu života i raznim faktorima ponašanja.

Ključne reči: Mortalitet, mortalitet prema uzroku, očekivano trajanje života pri rođenju.

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