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Mortality trends and depopulation in Serbia

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Abstract

The research presented in this paper is dealing with mortality and its impact on the natural increase, i.e. population dynamics in Serbia at the beginning of the 21st century. The aim is to draw attention to the potential of mortality as a natural component of changes in population when it comes to the possibility of mitigating the negative population trends. This paper will analyse changes in the age patterns of mortality of Serbian population from the mid 20th century, in order to point to the lack of progress in reducing age-specific mortality. The comparison with countries with low mortality rates (Slovenia and Sweden) will highlight the potential space for further mortality reduction in Serbia. The effect of a hypothetical fall of mortality by age on the level of natural increase will be measured on the basis of population projections for the period of half a century.

Keywords: mortality, depopulation, natural change, Serbia

Introduction

At the beginning of the 21st century, the situation in European countries in terms of fertility is quite uniform. Despite the fact that many have a long-standing practice of encouraging birth, few countries have managed to maintain the level of births over the required for simple reproduction (Frejka, Sobotka, 2008). In Serbia the birth rate has not been sufficient for simple reproduction of population for six decades (Penev, 2001), and the total fertility rate in the second decade of the 21st century is around the average for European countries. In contrast to the relatively uniform values at birth on the European continent, there are large differences in population mortality among countries. Serbia, with the crude death rate of 14.2 per 1000 is among the most vulnerable countries in Europe and the world. A higher mortality rate in Europe, based on data for 2011, is only that of Bulgaria, Ukraine and Belarus (Eurostat 2013). Comparison among the former Yugoslav republics shows that Serbia is leading, followed by Croatia (11.6 per 1000), Macedonia (9.5 per 1000), Montenegro (9.4 per 1000), Bosnia and Herzegovina (9.2 per 1000) and Slovenia (9.1 per 1000). Specific mortality rates by age in Serbia are from 2 up to 3 times higher than those of the most developed European countries. In Serbia, life expectancy at birth (E_o) compared to the countries of Northern and Western Europe, is by 5-7 years lower for men (in 2011 E_o is 71.5), and 6-8 years for women (in 2011 E_o is 76.7).

As a result of decades of low fertility rates and insufficient progress in reducing mortality, Serbia is in the third decade of negative population increase and with a negative migration balance (in the last intercensal period), it belongs to the group of countries that have exceptionally large population decline. Since 1992, more deaths than births have been registered, and the difference has been larger by every year (in 2011, 37 thousand more deaths than births). In the last two decades, slightly over half a million inhabitants (518 thousand) more have died than have been born. In the last intercensal period only (2002-2011) the negative natural increase was 297 thousand, and net emigration was about 65 thousand, (Penev, Marinković, 2012), which indicates that population decline in Serbia is primarily the result of a negative ratio between births and deaths while the impact of emigration is significantly lower.

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This paper will analyse changes in the age patterns of mortality of Serbian population from the mid 20th century, in order to point to the lack of progress in reducing age-specific mortality. The comparison with countries with low mortality rates (Slovenia and Sweden) will highlight the potential space for further mortality reduction in Serbia. The effect of a hypothetical fall of mortality by age on the level of natural increase will be measured on the basis of population projections for the period of half a century.

Methods

In researching mortality and mortality by cause of death, the transversal method of data analysis was used. The technique of standardised rates was applied for comparative purposes, also we were using the decomposition method. The use of specialised computer software, Dem.Proj 3.34 was necessary for the projections and SPSS for statistical analysis. The research was conducted on the entire population set of the Republic of Serbia (excluding Kosovo and Metohija) in the period from 1950 to 2012, and depending on the level of analysis was limited to the period around the years of population censuses, starting from 1953 to 2011. The data about the deceased was taken from vital statistics and about population size (total and by structures) from census statistics. In addition, the data was taken from websites as well: World Health Organisation (WHO), European Statistical Agency (Eurostat), databases of vital events for selected countries developed by institutes of Berkeley and the Max Planck (Human Mortality Database) and national statistical services.

Results and discussion

Basic characteristics of mortality in Serbia

Trends of the crude death rate in Serbia from the mid-20th century show that the lowest values were recorded during the 1960s, when they were in the range of 8-9 per 1000, and highest at the beginning of the 21st century, about 14 per 1000. Serbia is one of the demographically oldest countries of the European continent (Penev, 2014), and aging of the population has a decisive role in the crude death rate. The population of Serbia was the demographically youngest in the 1960s, and a strong relationship between mortality and reached demographic age has caused the lowest rates of overall mortality.

To what extent the increase in overall mortality is the consequence of change in the age structure or the impact of reduction in mortality by age, it is possible to show through the decomposition of differences in the general mortality rates for two periods (Preston, et al., 2001). The analysis was done for the level of mortality in 1961 (based on the three-year average of deaths in 1960-62, the overall rate was 9.1 per 1000) and in 2011 (based on the three-year average of deaths in 2010-2012, the overall rate was 14.2 per 1000) The difference in crude death rate in Serbia during a period of five decades is significant and amounts to 5.1 per 1000. It is the result of simultaneous action of two opposing influences: the age structures whose negative changes reflected in an increase in general mortality rates by 8.9 per 1000, and on the other hand age-specific mortality, which declined almost continuously and contributed to a reduction in mortality by 3.8 per 1000. Proportionately, greater impact on overall mortality was achieved by age structure. Age-specific mortality declined, more intense in the beginning of the observed period, the highest decline being in the youngest age groups and thus had a positive effect on overall mortality. However, looking at the entire period, its impact was more than twice neutralised by the changes in age structure.

The general social and economic conditions, especially improvements in health protection of the Serbian population since the mid-20th century, have caused the decline of specific mortality rates (Radivojević, Marinković, 2014). Although the rate decline was continuous, the intensity of decline was not the same in all age groups. A significant rate decline were recorded in children under five years of age, to a lesser extent in the category of young and middle-aged population, and much less in those over 65 (Figure 1).

The greatest reduction in mortality in the period from 1950 to 2011 was recorded in infants. In the early second half of the 20th century, children under one year of age were on average dying at the rate of 100 per 1000 (Tasić, 1966), which in the European context of that time represented exceptionally high mortality rate. Intense fall in infant mortality occurred as soon as in the 1950s and in the early 1960s the rates were on average lower by 35%. The lowest infant mortality was recorded in the last year of the research and was 6.2 per 1000. In most developed countries infant mortality is about 3 per 1000 (National Center ... 2014). Large decrease was also in children in the age group 1-4, where the rates were reduced by as much as 30 times in the observed period.

Life expectancy at birth (E_o) in the period from 1953 to 2011 shows an increase of about 13 years, from 61.3 (in 1953) to 74.6 (in 2011). The only period of stagnation and a slight deterioration was recorded in the first half of the 1990s. The greatest importance for the growth of E_o had a reduction in infant mortality. It has contributed to almost half of the total increase (46.8%) in the amount of 6.2 years (the used meth-

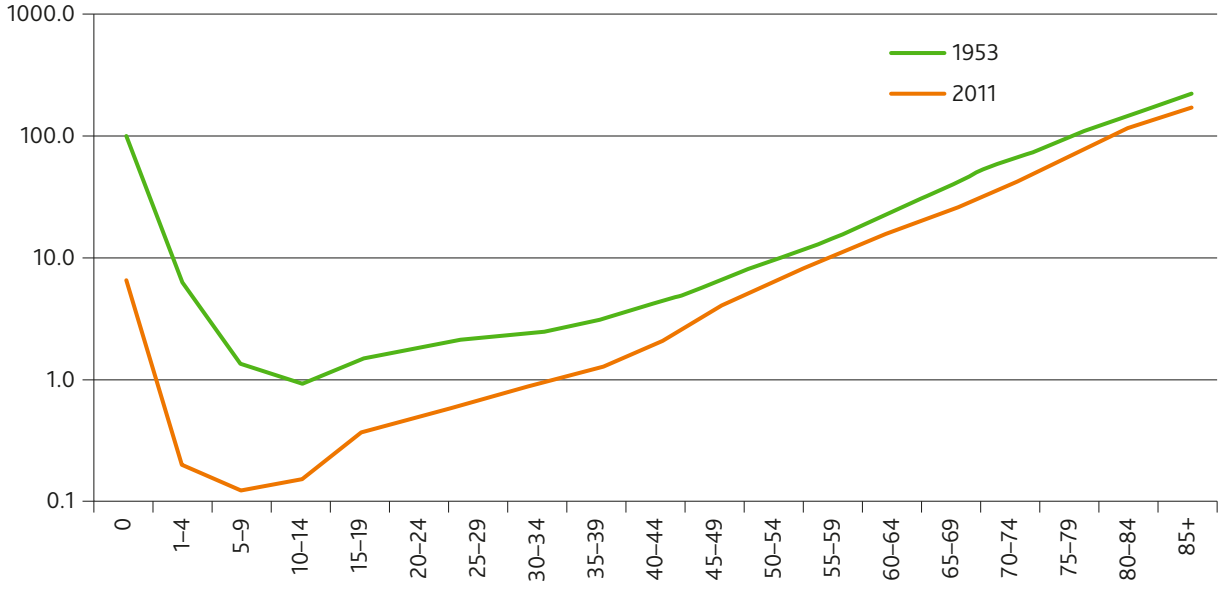

Figure 1. Specific mortality rates in Serbia, 1953 and 2011.

odology described in Preston, et al., 2001). Children aged 1-4 was significantly contributed to the increase in life expectancy of 1.6 years, or 11.8% of the total increase in E_0. All other age groups have contributed to E_0 with a 5.5 year. This increase is almost evenly distributed at five-years age groups with a share of 2% to 4%. In older groups, the improvement of mortality situation is insignificant, which is the main cause of the relatively low life expectancy in Serbia (in the European context). The high mortality rate of the population of Serbia and the potential of its reduction can be best perceived by comparing with respective countries that are exceptionally successful in the field of reducing their mortality rates.

Difference in mortality among Serbia, Slovenia and Sweden

When Serbia is compared to developed countries, Slovenia and Sweden are a good example for the approximation of a desirable mortality model (Radivojević, 2006). Slovenia, because it is a neighbouring country (and a part of the former Yugoslavia) and with the health system similar to Serbian. Sweden, which is one of the top countries in the world by life expectancy at birth for both sexes, and with the number of inhabitants slightly above Serbia.

Age-specific mortality rates in Serbia, Slovenia and Sweden (Figure 2) show the extent of unfavourable mortality situation in Serbia. Especially when comparing data from 1953 and 2011, where it can be clearly concluded that the difference in age-specific mortality rates increased, i.e. that the rates decreased faster in Slovenia and Sweden. In the period of six decades rates in the age group 60-79 in Sweden on average decreased by 2.4 times, in Slovenia by about 2.2 times, while at the same time in Serbia an increase of about 50% was registered. It should be particularly emphasised that the improvement in age groups 70-74 and 75-79, is the same in Slovenia and Sweden. In the elderly 80-84 and 85 and over, rates in Slovenia and Sweden are by about 2 times lower and in Serbia the decrease is below 30%. The difference in mortality rates between Serbia and Sweden in all age groups also increased in 2011 compared to 1953 and is higher, depending on the age group from 3% to up to 5 times, as it is the case in the elderly over 85.

Broken down by sex, the bigger difference in mortality is in men than in women. It should be noted that men in Serbia (2011) aged 45-74 have higher mortality rates than their counterparts in Sweden had 60 years ago. Their life span is now on average about 8 years shorter. The most vulnerable age group of men in this comparison is the group 50-54 (three times higher mortality than in Sweden), all age groups from 35 years of age have more than twice higher mortality rates than their counterparts from Sweden (exceptions are the elderly 80-84 and 85 and over where rates are by around 50% higher). Women are somewhat more favourable position. The difference in specific mortality rates is slightly smaller and ranges from 20% to 240%. The most unfavourable ratio is of women aged 75-79 where mortality is almost 2.5 times higher. Overall, on the basis of a comparison with Sweden, in men older middle-aged population is most at risk, and in women it is the elderly.

Slovenia has a remarkable progress in reducing specific mortality rates by age and sex. In all age groups, the rates are more significantly reduced than in Serbia (exceptions are men 85 and over where rates are less reduced than those in Serbia). Unlike Sweden, which

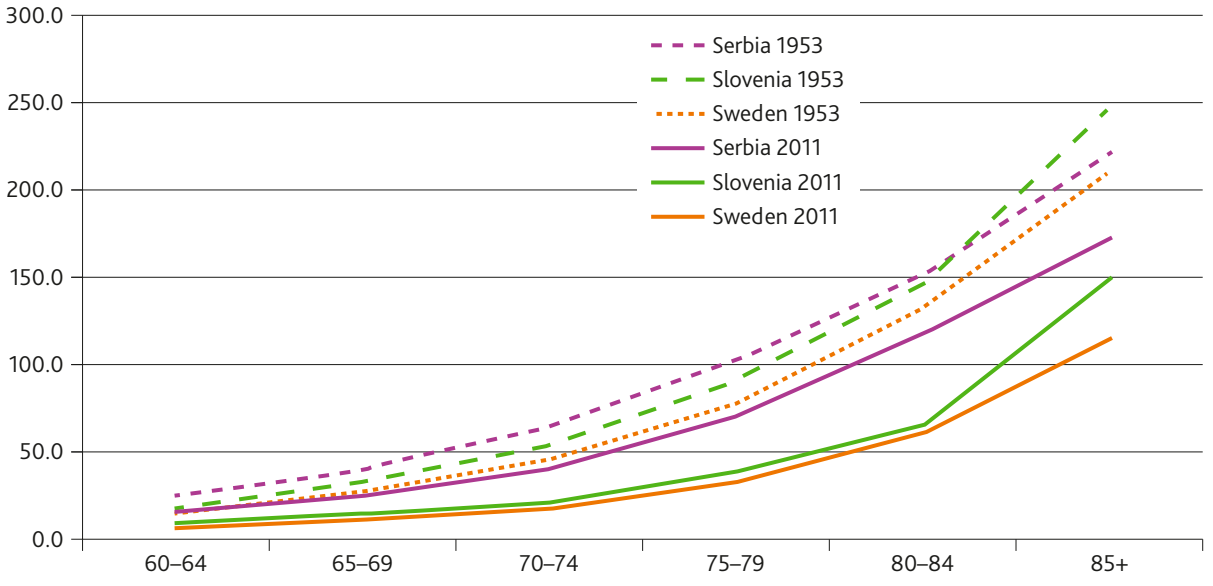

Figure 2. Specific mortality rates of the elderly in Serbia, Slovenia and Sweden, 1953 and 2011. v

as early as in 1953 had for certain age more favourable mortality than the one in Serbia, it was not the case in Slovenia. The difference between Serbia and Slovenia in mid-20th century was not pronounced, but in the past six decades increased, reaching the difference that Serbia has with Sweden. Women in Slovenia had a particularly great reduction in mortality, which in the elderly accounted for more than three times. In the age group 70-74, mortality rates were reduced by as much as 3.7 times.

The analysis of mortality according to the cause of death clearly shows the reasons the difference in mortality increased among the observed countries, to the detriment of the citizens of Serbia. Chronic non-communicable diseases dominate the mortality of all three populations but the prevalence of specific groups of diseases is different. Data for 2011 show that the observed countries have a different model of mortality according to the cause of death. Comparison of the five most common causes of death in all three populations shows that two groups of death causes are responsible for a less favourable position of the Serbian population. These are especially diseases of the circulatory system and tumours to a lesser extent (Table 1).

The main reason for the relatively high specific mortality rates in Serbia, especially of the elderly lie in the high rates of mortality from cardiovascular diseases. While most countries in the northern and western part of Europe greatly reduced the death rate from cardiovascular diseases as early as during the 1970s, it was not the case in Serbia (Marinković, 2012). The concept of falling mortality rates from cardiovascular diseases in the literature is known as the "cardiovascular revolution" and it greatly influenced the reduction of mortality of older middle-aged and old population, which greatly extended the average life expectancy (Olshansky, Ault, 1986; Rogers, Hackenberg, 1987). Historically perceived, the highest values of cardiovascular diseases were recorded in Serbia in 2005, and since then, with minor yearly fluctuations, they have shown a trend of slight decline.

Impact of mortality on population decline in Serbia

In a hypothetical situation, in which the mortality rates in Serbia were the same as in Sweden, the current annual number of deaths would have been significantly lower, which would have a positive effect on the level

Table 1. Leading causes of death for 2011, Serbia, Slovenia and Sweden (rates per 100,000).

Causes of death	Serbia		Slovenia		Sweden	
	Male	Female	Male	Female	Male	Female
Neoplasms	350.5	245.4	324.4	253.9	252.1	229.5
Diseases of the circulatory system	723.5	810.7	293.9	415.1	353.7	386.2
Diseases of the respiratory system	86.4	53.7	59.7	57.0	59.6	61.2
Diseases of the digestive system	55.8	41.8	60.0	48.3	27.6	28.8
External causes of morbidity and mortality	69.7	24.2	106.4	55.8	61.1	36.9

of natural increase. The analysis in this paper is based on this assumption. Namely, with the age-sex structure of population in Serbia in 2011 and the level of fertility for the same period, the number of deaths would be halved, but on condition that the mortality rates by age and sex were the same as the rates in Sweden in 2011. Half the number of deaths implied in that case a positive natural increase of about 20 thousand. The impact of hypothetical, lower mortality rates would be the highest in older age, in which the difference between the hypothetical and the actual number of deaths would be the largest. For the population under 60 years, the number of deaths would have decreased by 8.5 thousand, while in younger than 70 years, over 17 thousand. The biggest difference in the real and the hypothetical number of deaths would have been achieved with the oldest population. The most intensive decrease in the number of deaths would be at the most vulnerable age group 75-79 years, one fifth of the total reduction. For ages above 80 years, the number of deaths would be less 18.5 thousand.

The short-term effect of reducing mortality by age on the population dynamics is undeniable, but how important is it for a longer period of time, bearing in mind limitations of lifetime? According to the classical deterministic calculation of the cohort-component method, where fertility and mortality are constant throughout the projection period, the population dynamics of a closed population (no migration) of Serbia until 2061 was presented (Graph 3). In the projection specific fertility rates for Serbia were used, as well as Slovenian and Swedish survival rates by age and sex, all from 2011. As an illustration, Table 2 shows the values of synthetic indicators of fertility and mortality (total fertility rate (TFR) and the length of life expectancy at birth) for Serbia, Slovenia and Sweden.

Table 2. Synthetic indicators of fertility and mortality for 2011, Serbia, Slovenia and Sweden.

Countries	Total fertility rate	E_0 - males	E_0 - females
Serbia	1.4	71.9	77.1
Slovenia	1.6	76.8	83.3
Sweden	1.9	79.8	83.7

The current reproductive norms of the Serbian population (from 2011) along with the hypothetical acceptance of Slovenian and Sweden mortality pattern shows that the negative relation between births and deaths in Serbia cannot be stopped in the long term (Figure 3). The importance of reducing mortality lies primarily in mitigating depopulation trends, which for a short time (about five years, the period Swedish survival rates applied) improves the relation between births and deaths (positive natural increase is about 14 thousand). Already in the second half of the 2011-2021 period the impact of hypothetical mortality weakens, and natural increase again has a negative trend. Compared to the intercensal period 2002-2011, when natural increase was –297 thousand, in the period 2011-2021 it would be around –63 thousand, assuming the Swedish mortality rates. If the natural increase was achieved with Slovenian rates, it would be negative at around 160 thousand in the period 2011-2021. In contrast, assuming the retention of the current values in Serbia, negative natural increase in the same period would amount to nearly –470 thousand. The difference in

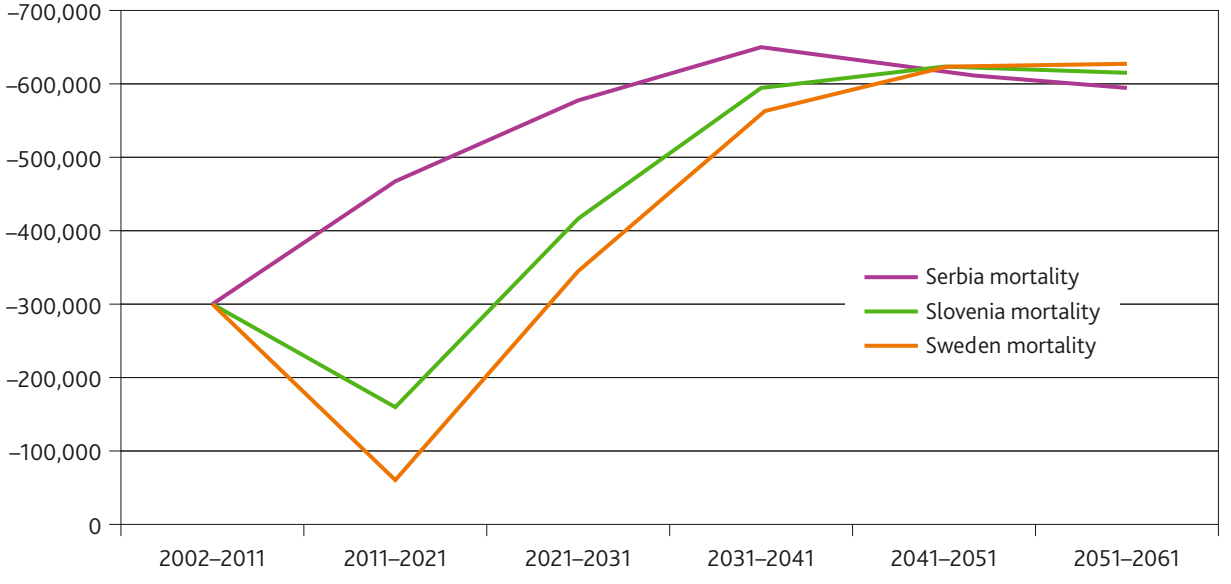

Figure 3. Natural increase of Serbia – registered and projected, 2002-2061.

the coming ten-year intervals intensively increases (the Swedish rates) and in less than a decade, returns to the level from 2011. In that way, the effect of positive changes in population mortality would be annulled, and generally speaking in about two decades natural increase would be as at the beginning of the projection. By the end of the projection horizon the difference will stabilise at twice higher values than those from the period 2002-2011. Specifically, the results show that there are over 600 thousand more deaths than births observed by ten-year intervals. Already in the period 2031-2041, the natural increase in Serbia would be at the level of –650 thousand, with the current level of mortality and fertility rates by age. The importance of positive changes in population mortality, when it comes to natural increase, is reflected primarily in mitigating depopulation trends and extending the period of time necessary for the fertility and immigration to have their effect on the age structure of the population, without which in the long run it is not possible to prevent population decline.

Conclusion

The current level of mortality in Serbia is the result of long-term changes in its trends. They have been positive and implied declining mortality rate and especially the elimination of unnecessary deaths. However, mortality rates, primarily of the elderly, are not sufficiently reduced, which at the beginning of the second decade of the 21st century, puts Serbia in the position of lagging behind the developed European countries (Marinković, 2010). Along with insufficient births, high general mortality rate contributes to negative increase and depopulation.

The analysis showed that for the positive impact of mortality on the population dynamics of Serbia, it was necessary to significantly reduce the mortality rate by age (for example, to the level of those in Slovenia and Sweden). However, even in this very hypothetical situation, given that the reduction in mortality cannot be achieved in the short term, depopulation would be alleviated only in the short term. Already after two decades, the negative natural increase would be at the level of that of the base period. The low level of mortality would be irrelevant to the current depopulation. Stopping the depopulation would depend only on the level of birth or immigration of young people.

However, mitigate and combat depopulation by encouraging long-term birth, does not exclude the measures and activities to improve the conditions of mortality in Serbia. The effects of population policy in the field of mortality can provide faster and more significant results, especially in certain aspects of lowering mortality (lessening of violent death among young people, especially in traffic accidents). Preventing the development of serious chronic diseases through control and elimination of the risk factors is the way to reduce mortality. Later occurrence of degenerative diseases provides an opportunity to reduce the mortality rate at all ages over 65 years, where rates are significantly higher in Serbia than in most developed countries. Raising awareness about the need to care for their own health, as well as personal responsibility for the way and lifestyle are of great importance.

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