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**IMPACT OF STRUCTURAL AND SOCIO-ECONOMIC FACTORS
ON THE NUMBER OF BIRTHS AND DEATHS
IN THE REPUBLIC OF BELARUS**

It is believed that The National Demographic Security Program for 2011–2015 will be able to overcome the depopulation in Belarus. Effectiveness of its implementation is very important not only for demographic but also the national security of the country. To estimate the impact of demographic policy as part of the social-economic factors special methods are proposed. It also allows separating influence of structural factor. The main conclusions of the research are that structural factors have changed their focus and they are currently blocking the implementation of the Program. During the period of 2011–2013 structural factors had a negative impact both on the changes in the number of births and deaths in the country, while The National Demographic Security Program for 2011–2015 has been successful and most targets have been achieved already in 2013.

Key words: National Program of Demographic Security, socio-economic, structural factors, fertility, mortality

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**ВПЛИВ СТРУКТУРНИХ І СОЦІАЛЬНО-ЕКОНОМІЧНИХ ЧИННИКІВ
НА КІЛЬКІСТЬ НАРОДЖЕНЬ І СМЕРТЕЙ У РЕСПУБЛІЦІ БЕЛАРУСЬ**

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Національна програма демографічної безпеки на 2011–2015 роки сприятиме подоланню депопуляції в Беларусі. Ефективність її реалізації дуже важлива не лише для демографічної, а і національної безпеки країни. Для оцінки впливу демографічної політики як частини соціально-економічних чинників застосовуються спеціальні методи. Програма дозволяє відокремити вплив структурного чинника. Основні висновки дослідження показали, що структурні чинники змінили свій фокус і в даний час блокують реалізацію програми. За період 2011–2013 років структурні чинники справляють негативний вплив на зміни кількості народжень на зміни кількості смертей в країні, тоді як реалізацію Національної програми демографічної безпеки на 2011–2015 роки можна визнати успішною з огляду на те, що основні її завдання вирішено в 2013 році.

Ключові слова: Національна програма демографічної безпеки, соціально-економічні, структурні чинники, народжуваність, смертність.

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ВЛИЯНИЕ СТРУКТУРНЫХ И СОЦИАЛЬНО-ЭКОНОМИЧЕСКИХ ФАКТОРОВ НА ЧИСЛО РОЖДЕНИЙ И СМЕРТЕЙ В РЕСПУБЛИКЕ БЕЛАРУСЬ

Национальная программа демографической безопасности на 2011–2015 годы будет способствовать преодолению депопуляции в Беларуси. Эффективность ее реализации очень важна не только для демографической, но и национальной безопасности страны. Для оценки влияния демографической политики как части социально-экономических факторов применяются специальные методы. Программа позволяет отделить влияние структурного фактора. Основные выводы исследования показали, что структурные факторы изменили свой фокус и в настоящее время блокируют реализацию программы. В период 2011–2013 годы структурные факторы оказывают негативное влияние на изменения числа рождений и на изменение числа смертей в стране, тогда как реализацию Национальной программы демографической безопасности на 2011–2015 годы можно признать успешной в виду того, что основные ее задачи решены в 2013 году.

Ключевые слова: Национальная программа демографической безопасности, социально-экономические, структурные факторы, рождаемость, смертность.

Problem statement. Demographic processes are influenced by two group of factors. The first one is structural, including composition of the population by sex, age, marital status. All of them actively influence both the number of births and deaths and birth and death rates. But there is the second group of factors which mostly impacts the total fertility rate and life expectance. It includes social and economic factors. The main factor is the quality of life, especially financial situation and living conditions. Welfare gains in turn are accompanied by changing of other factors affecting both fertility and mortality (for example, human needs, level of education, poverty, health and others). Socio-economic factors also include implementing measures of demographic policy. Currently there is the National Demographic Security Program for 2011–2015 in Belarus [6]. Effectiveness of its implementation is very important not only for demographic but also the national security of the country. Therefore, assessing the current situation is an essential challenge.

The efficiency of the programs is primarily evaluated by the number of births and deaths and the total fertility and mortality rates. These are the most common indicators which are

publicly available. However, there is a method of more accurate assessment of the impact of demographic policy. It is based on using more accurate data: the probability of birth and death. The method is capable of demonstrating the changes of intensity of demographic processes. It also allows separating the impact of structural and socio-economic factors. To achieve this aim we used a special technique based on probabilistic terms and hypothetical calculations, the basic principles of which have already been presented in the literature [7]. There are some points of these techniques in the paper.

The data and method. The data on current demographic estimates for the period 2006–2013 are used. The data are obtained from the National Statistic Committee of The Republic of Belarus.

To analyze the fertility, the data on one-year age-specific birth rates, the probability of women giving birth during the reproductive period (15 to 49 years) by each age and the total number of birth for each year were taken.

Using the method the hypothetical number of births is estimated. It means the number of children that would be born in the next year of the program, if the average size and age structure of the female population is real to reality but the probability of birth is in the previous period (for example, before the program). Thus, it is a hypothetical number of births that would be calculated in the year, if the dynamics of the number of births was influenced only by the changes in the structure of population.

$${}_nB^h = \sum_{15}^{49} F_x^0 \times {}_n P_x^1,$$

where ${}_nB^h$ – hypothetical number of births;

n – study period;

x – age;

F_x^0 – age-specific probability of birth in the basic year;

${}_n P_x^1$ – average number of women by age during the study year.

The difference between the real number of births in the study year and the findings show the number of births, which is obtained only by changing the age-specific fertility rates. This is the result of socio-economic factors.

$$\Delta_n B^{\text{sec}} = {}_n B^r - B^h,$$

where $\Delta_n B^{\text{sec}}$ – increase of births due to socio-economic factors;

${}_n B^r$ – number of birth in the study year.

In its turn, the impact of the structure is estimated as:

$$\Delta_n B^{\text{str}} = B^h - B^0,$$

where $\Delta_n B^{\text{str}}$ – increase of births due to structural factors;

B^0 – the number of birth in the basic year.

To study the mortality rates we used the data on one-year age-specific death rates, the probability of men and women dying in a life period (0 to 100 years) by each age and the total number of deaths for each year.

In contrast to fertility research the mortality one proposes a separate estimation by sex. Total number of deaths is the sum. Under this method the first step is the calculation of the hypothetical number of deaths in a study year. So there is the number of deaths if the average size and age structure of the population is real but the probability of dying remained at the level of the basic year.

Consequently, the hypothetical number of deaths separately for men and women is calculated:

$${}_nD^h = \sum_0^{\infty} M_x^0 \times {}_n P_x^1,$$

where ${}_nD^h$ – hypothetical number of deaths by sex;

n – study period;

x – age;

M_x^0 – age-specific probability of death by sex in a basic year;

${}_n P_x^1$ – average number of population by age and sex during the study year.

Thus, the impact on two groups of factors is estimated by the next formulas:

$$\begin{aligned} \Delta_n^f D^{\text{sec}} &= {}_n^f D^r - {}_n^f D^h \\ \Delta_n^m D^{\text{sec}} &= {}_n^m D^r - {}_n^m D^h, \end{aligned}$$

where $\Delta_n^f D^{\text{sec}}$ – the number of saved women due to socio-economic factors;

$\Delta_n^m D^{\text{sec}}$ – the number of saved men due to socio-economic factors

${}_n^f D^r$ – number of deaths in the study year.

$$\begin{aligned} \Delta_n^f D^{\text{str}} &= {}_n^f D^h - {}_n^f D^0 \\ \Delta_n^m D^{\text{str}} &= {}_n^m D^h - {}_n^m D^0, \end{aligned}$$

where $\Delta_n^f D^{\text{str}}$ – the number of saved women due to structural factors;

$\Delta_n^m D^{\text{str}}$ – the number of saved men due to structural factors;

${}_n^f D^0$ – the number of female deaths in a basic year;

${}_n^m D^0$ – the number of male death in a basic year.

The total effect is just the sum of the results for men and women.

Main results. Analysis of the general coefficients led to the conclusion about the effectiveness of implementation of the National Program of Demographic Security of the Republic of Belarus for 2007–2010. Most of the aims of the program were achieved (Table 1).

One objective was not achieved – the death rate was 14.4‰, against the planned reduction to 10–11‰. However, it was the program error. The structural factors had not been fully taken into account when designing the program.

The main goal of the proposed methods is to avoid such problems in the future. To solve this problem it is recommended to evaluate the effectiveness of the implementation of socio-economic activities by probabilistic indices.

Thus, the calculation of evaluation factors on the dynamics of the number of births and deaths for the period 2007–2010 revealed some interesting trends. As it turned out, the structural factors that had a significant impact on the birth rate in the Republic of Belarus in the first decade began to exert little influence. In 2010 the impact of structural factors has changed its focus and became a drag on growth in fertility. Calculations showed that in the four years of the program 428,8 thousand children were born in the country and that is almost 42 thousand more than it would be if the birth rate had stayed at the level as in 2006. Moreover, almost all births increase occurred due to social economic factors. As a result, the 2010 total birth increase by 57 was less than the increase due to the only socio-economic factors.

Structural factors also favorably impacted the dynamics and the number of deaths. During the period 2007–2010 539,100 people died in the Republic of Belarus, including 256,600 women and 282,500 men. In general, due to the positive effect of two groups of factors 14,600 lives were saved. Due to structural changes the total number of deaths decreased by 5,000 people. And to a large extent this was due to changes in the structure of the male population. If the dynamics of the number of deaths had no positive influence of socio-economic factors the total number of deaths would be more on 9,600.

Table 1. Results of the National Program of Demographic Security of the Republic of Belarus for 2007–2010 [5]

Indicators	Planned	Real
Birth rate	10–11‰	11,4‰
Total fertility rate	1.4–1.5	1.494
Infant mortality	up to 6‰	4‰
Life expectancy at births	up to 70–72	70,4
Death rate	up to 10–1‰	14,4‰.
Net international migration	5 000	10300

Source: [1, 2].

Thus, lives were saved in the Republic of Belarus thanks to the positive influence of socio-economic factors, including the implementation measures of the National Demographic Security Program. Among them, an important role was played by the successful realization of health promotion activity.

Consider in more detail the results of the calculation for the current period are as follows 2011–2013.

Fertility.

Table 2. Evaluation of the impact of structural and socio-economic factors on the number of births in the Republic of Belarus for the period 2011–2013

Indicators	2011	2012	2013	2011–2013
Total fertility rate	1.515	1.620	1.668	1.6
Real number of births	109147	115893	118281	343321
Changes in the number of births compared to 2010	1097	7843	10231	19171
Hypothetical number of births	107731	106906	105618	320254
Changes in the number of births due to structural factors	–319	–1144	–2432	–3896
Changes in the number of births due to socio-economic factors	1416	8987	12663	23067

Source: [calculated by the data of Belstat].

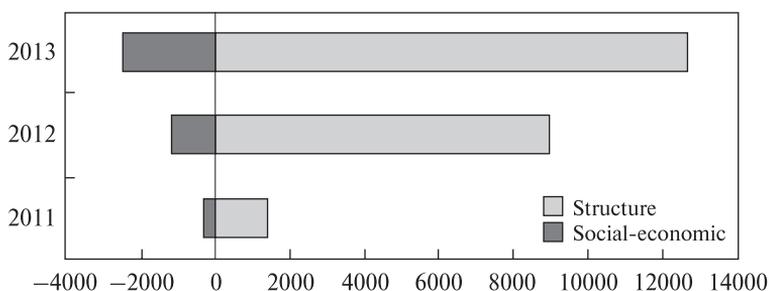


Fig. 1. Change in the number of births in Belarus in 2011–2013 under the influence of structural and socio-economic factors

Source: [calculated with the data of Belstat].

The total fertility rate has increased compared with 2010 in 2013 by 12% and amounted to 1,668 children per woman (Table 2). This is the highest rate since 1995. This positive effect was achieved thanks to a favorable socio-economic development (Fig. 1).

Over the three years of the national demographic security program for 2011–2015 the number of births rose by 23 thousand people only due to socio-economic factors, the effectiveness of which significantly mitigates the negative effect of the structure in the Republic of Belarus at the present stage in the context of the dynamics of the number of births.

As seen from the table, the structural role of negative factors with enhanced year by year. In general, over the 2011–2013 period due to structural factors the number of births fell by almost 4,000 and amounted to -20% of the total number of births gain obtained by socio-economic factors.

In the analysis of demographic processes it is necessary to consider the type of settlements. There are lower rates of increase of the number of births and higher rate of increase of the number of deaths in cities. In addition, age and sex differentiation of the population by type of settlements is observed.

The results show different direction of influence of structural factors at the moment. There is younger population in the cities of the Republic of Belarus. The average age in the cities more than 5 years below compared to the countryside. Nevertheless, high reproductive behavior (the total fertility rate in rural areas is 1.5 times higher than in urban areas) allows overcoming the negative effects of the structure in the villages, despite the triple population differences. Calculations showed that for the 2011–2013 period structural factors had a negative effect on the number of births in rural areas which is estimated at 11,000 children. But due to positive impact of the socio-economic factors the total number of birth has increased by 3,000.

During the 2011–2013 period fertility rates have evolved quite favorably. The age and sex structure ensured 3,600 births. The socio-economic impact was also positive – 12,700 births.

It is believed that the demographic situation in the capital of the Republic of Belarus is different. The study proved this. The population of Minsk is the fifth part of the total population of Belarus, so tracking changes in the demographic development in its territory is of particular importance. According to the calculation results for the 2011–2013 period 3,000 children were born in the capital because of the factors. But unlike all other territories, birth growth in Minsk by 90% was driven by favorable demographic structure of the population (Fig. 2).

The low impact of socio-economic factors suggests that more effective measures are needed to improve the matrimonial attitude in the capital. While this effect can be achieved

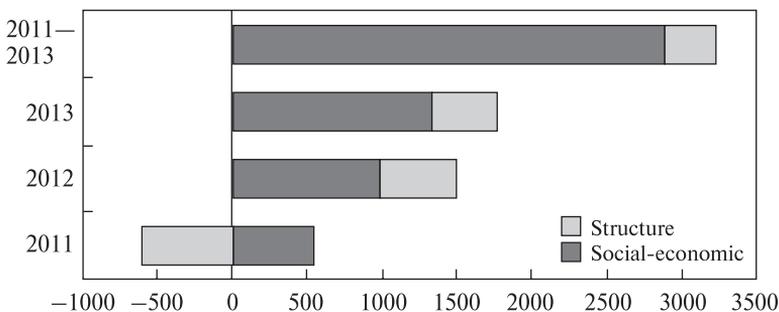


Fig. 2. Change in the number of births in the city of Minsk in 2011–2013 under the influence of structural and socio-economic factors

Source: [calculated with the data of Belstat]

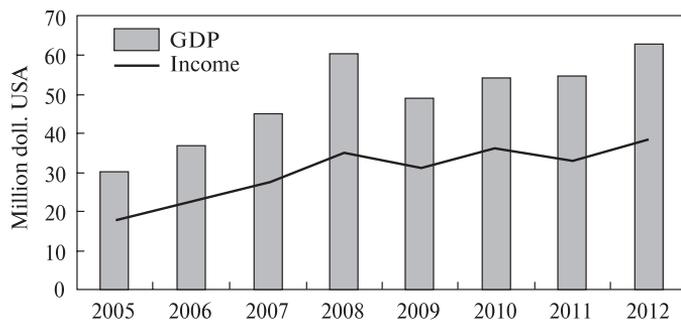


Fig. 3. Change in the GDP and income of households in Belarus in 2005–2012, billion USD

Sources: [3, 4].

by introduction of modern medical technologies and new methods of diagnosis and treatment, as well as increased access and improved quality of services provided to the population in other areas, it is already sufficiently developed in Minsk.

Moreover, being the center of the country, residents of the capital react faster to changing socio-economic nature. This is confirmed by the negative impact of socioeconomic factors on demographic processes in Minsk in 2011 (Fig. 3). Unlike other areas, there was a reduction of the number of births and growth in the number of deaths in the devaluation year in the capital. Moreover, if the 2009 devaluation of the Belarusian ruble falling cash income caused no reduction in purchasing power per capita disposable income of households, in 2011 the last dropped in almost all basic foodstuffs.

As a result, in 2011 the positive impact of structural factors on the number of births in Minsk eliminated the negative effect of socio-economic and led to a reduction in the number of births just to 31 cases. Since 2012 the development of the demographic processes has returned to the former course.

Mortality. The degree of influence of the socio-economic factors and the structure on the total change in mortality during the first three years of National Demographic Security Program for 2011–2015 was calculated.

Thus, over the 2011–2013 period the number of deaths in Belarus decreased by 24.4 thousand (Table 3 and Fig. 4).

Socio-economic factors had the greatest impact on reducing the total number of deaths. Among them, the successful implementation of measures of health promotion within the National Demographic Security Program for 2011–2015. In general, without the influence of socio-economic factors, for three years due to adverse structural changes the number of deaths would have increased by 3,500 people. It was almost all due to changes in the structure of the female population. The negative impact of the female structure in 2012–2013 did not allow realizing the positive changes in the socio-economic factors fully. The number of deaths among women decreased only by 8,300 cases. Males still had positive impact. So thousands of lives over three years were saved – over 16,000 men, including 12,600 due to the positive impact of socio-economic factors and 3,500 due to favorable demographic structure of the male population in the given period.

Analysis of the results of calculations by type of settlement suggests that cities are already beginning to show the negative impact of population structure. Thus, due to such effect the number of deaths of men and women in 2011–2013 had increased by 4,000. However, favorable socio-economic situation has avoided this. In fact, the overall decline of the number of deaths in urban areas was 7,000 people, including 700 women and 6,300 men.

Table 3. Evaluation of the impact of structural and socio-economic factors on the number of deaths in the Republic of Belarus for the period 2011–2013

Indicators	2011	2012	2013	2011–2013
<i>Men</i>				
Real number of deaths	71349	64931	63012	199292
Changes in the number of deaths compared to 2010	–440	–6858	–8777	–16075
Hypothetical number of deaths	70060	70600	71240	211900
Changes in the number of deaths due to structural factors	–1729	–1189	–549	–3467
Changes in the number of deaths due to structural factors	1289	–5669	–8228	–12608
<i>Women</i>				
Real number of deaths	63741	61600	62314	187655
Changes in the number of deaths compared to 2010	–1602	–3743	–3029	–8374
Hypothetical number of deaths	64057	65351	66557	195965
Changes in the number of deaths due to structural factors	–1286	8	1214	–64
Changes in the number of deaths due to structural factors	–316	–3751	–4243	–8310

Source: [calculated with the data of Belstat].

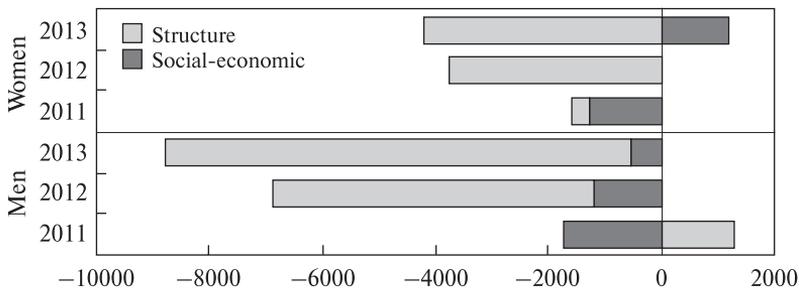


Fig. 4. Change in the number of deaths in the Republic of Belarus for 2011–2013 under the influence of structural and socio-economic factors

Source: [calculated with the data of Belstat].

The situation in rural areas continues to develop positively. The structural factors are aimed at reducing the number of deaths of men and women in the villages of the Republic of Belarus. Moreover, their influence is still significant even compared to the effectiveness of social and economic policy. In general, over the 2011–2013 period more than 17,000 lives were saved – 11,000 due to the current structure of the rural population and 3,000 due to socio-economic development and effective implementation of demographic security.

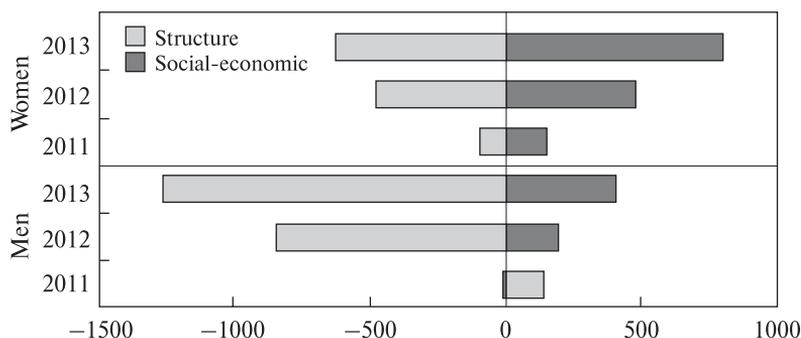


Fig. 5. Change in the number of deaths in Minsk for 2011–2013 under the influence of structural and socio-economic factors

Source: [calculated with the data of Belstat].

As noted above, the demographic development of the city of Minsk has its own specifics. Trends of mortality processes are no exception. On the one hand, the age and sex structure of the population of the capital has changed. So the number of deaths increases. As for women, the impact of structure is stronger than social-economic one. On the other hand the effect of the socio-economic measures in Minsk is weaker. In general, during the 2011–2013 period despite the favorable economic and social development the increase in the number of deaths among women was just 1,200, because of negative impact of the structure.

The structure also had a negative influence on the number of deaths of men (Fig. 5).

Nevertheless, thanks to the effective implementation of policy of healthy lifestyle it is still possible to reduce the number of deaths among the male population. Effect of socio-economic factors and the implementation of measures of the National Demographic Security Program for 2011–2015 saved 2,000 men in Minsk. The total number of saved lives of men for the 2011–2013 period amounted to 1,400.

The table shows the demographic indicators according to the National Demographic Security Program for 2011–2015 in 2013.

Data analysis showed that the main task of ensuring security demographic was completed even in 2013. Among them increasing the total fertility rate to 12,5‰ (under planned for 2015 – 12,0‰); increasing the total fertility rate to 1.67 children (under planned for 2015 – 1.55–1.65); rising the life expectancy at birth to 72.6 years (under planned for 2015 – 72–73 years); reduction in the overall mortality rate of the population to 13,2‰ (under planned for 2015 – 13,5‰). In the next 2 years it will be important to keep the temperature at least.

Table 4. Results of the first three years of the National Demographic Security Program for 2011–2015

Indicators	Planned for 2013	Real in 2013
Birth rate	11,6‰	12,5‰
Total fertility rate	1,52	1,67
Infant mortality	3,8‰	3,5‰
Life expectance at births	71,4	72,6
Death rate	13,5‰	13,2‰

Source: [calculated with the data of Belstat].

Conclusions. Evaluating the impact of the implementation of National Demographic Security Program for 2011–2015 has shown that structural factors have changed their focus and they are currently blocking the implementation of the Program. During the 2011–2013 period structural factors had a negative impact both on the changes of the number of births and deaths in the country. The influence on mortality was more significant. All increase the number of births and 85% overall reduction in the number of deaths occurred due to socio-economic factors. In the coming years changes are expected in the demographic structure of which will strengthen the negative impact of structural factors on the dynamics of basic demographic processes. There is a growth of people who were born in the 90s, when the birth rate was very low in Belarus. It will reduce the number of births. On the other hand there is also the growth of elderly people because of high fertility after World War II. It will cause the increasing number of deaths. It seems impossible to repay the depopulation. The main aim is not to worsen it.

The study showed that the basic demographic National Demographic Security Program for 2011–2013 is successful and most targets have already been achieved by 2013. However, it is not enough to establish population growth. Belarus does not reproduce its. Despite some growth in recent years, the birth rate in the country remains low. They provide a reproduction of the population only by 65–70 %. Life expectancy is lower by 10–15 years compared to developed countries. Net migration of the last 20 years is positive, but the volumes are insignificant and could not compensate for the natural decline in population.

It is important to monitor the annual implementation programs demographic security measures. Analyzing the changes in the development of demographic processes could help the proposed methods of evaluating the effectiveness of existing measures.

Thus, demographic security in the long run will be the one of the most problematic aspects of economic security that requires greater attention. The timely correction of the measures will significantly mitigate the negative effects and prevent undesirable consequences. The prerequisite for ensuring national security is the successful solution of demographic problems, which should not be delayed in the future.

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