Regional Reserves for Raising Life Expectancy in the Conditions of Convergence of Its Level*

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Abstract. The goal of the paper is to assess changes in the regional differentiation of life expectancy in Russia for 2003–2017, to consider the features of the level and growth rate of life expectancy, gender differences in the indicator, the difference between urban and rural areas, the structure of mortality due to death, the level of infant mortality in the regions of Russia; the paper also defines regional reserves for further increase in life expectancy. The relevance of the topic is due to significant regional differentiation, Russia's significant lagging behind developed countries, and the goals associated with this field. We arrange Russian regions into nine groups with annual intervals of the indicator and evaluate the changes in the groups in 2003–2017. We find out that in the conditions of growing life expectancy there has been a marked convergence of regions; they approached the Russian average level according to this indicator.

Regional convergence has occurred at the expense of the extreme groups in terms of the indicator, and primarily due to the lagging regions getting closer to the leaders; i.e. we observe the catch-up nature of convergence. This suggests that over the period of 2004−2017, the relatively easy-to-implement life expectancy growth reserves, which are typical for low-indicator regions, have been used quite well, while further growth in high-indicator regions is not an easy task, since the possibilities of first-order factors, such as gender differentiation, the difference between urban and rural indicators, the share of mortality from external causes, and infant mortality rate, have been largely implemented. Nevertheless, all nine groups of regions still have reserves to increase life expectancy, due to certain growth factors of the first order. The groups with the most unfavorable level of the indicator have the greatest reserves. However, factors such as the lag in the rural indicator and the value of infant mortality in the group with very high life expectancy provide opportunities for further increase due to growth factors of the first order.

Key words: life expectancy, Russian regions, regional convergence, grouping, first-order growth factors, gender differentiation, differences between urban and rural settlements, causes of death, infant mortality.

Introduction

May 7, 2018 the Russian President signed the Decree "On the national goals and strategic objectives for development of the Russian Federation for the period up to 2024"[1], which declares that one of Russia's development priorities is to achieve life expectancy of 78 years by 2024, and 80 years by 2030. The scale of the tasks at hand and Russia's significant lag behind the industrialized countries determine the relevance of research in the field of reserves and opportunities for increasing life expectancy of Russians.

Over the past decade and a half, Russia has made significant progress in reducing mortality and increasing life expectancy. In 2003−2017, the crude death rate decreased from 16.4 per 1,000 people to 12.4‰ − by 24.4% (in 2018, a slight increase was registered)[2]. In parallel with the decline, there have been positive changes in the structure of mortality due to causes. The most significant rates of decline are typical of deaths from external causes (accidents, poisonings, injuries, murders, suicides); as a result, in 2006, this group moved from the second to the third position in the structure of mortality due to causes, and the second position was occupied by mortality due to neoplasms. Life expectancy of Russians increased by 8.1 years and reached 72.9 years in 2018 (67.8 for men and 77.8 for women). These are the maximum values in the history of Russia. Nevertheless, the gap from developed countries is still about 12 years, more than 15 years for men and more than 10 years for women [1, p. 64].

In 2003−2018, the indicator for men increased more significantly − by 9.3 years (from 58.5 to 67.8 years), for women − by 5.9 years (from 71.9 to 77.8 years). I.e. along with the increase in life expectancy in Russia there was a reduction in gender differentiation in this indicator from 13.4 to 10.0 years, but the indicator for men is still lagging significantly behind; it represents a considerable potential for growth in life expectancy [2]. In urban areas, the level of this indicator reached 73.3 years in 2018, in rural areas − 71.7 years. Until 2009, the increase in life expectancy of the urban population was more significant; differences

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[1] Decree of the President of the Russian Federation "On the national goals and strategic objectives for development of the Russian Federation for the period up to 2024" dated May 7, 2018 No. 204. Available at: http://www.kremlin.ru/acts/news/57425

[2] http://www.gks.ru

between the city and the village in 2003−2009 increased from 2.0 to 2.9 years. In recent years, the rural indicator has been increasing at a higher rate. However, the period 2003-2018 as a whole does not yet show a noticeable reduction in the backlog: in 2018, its level is 1.6 years lower than the urban one − the tightening of the life expectancy of the rural population is also a growth reserve [3].

The Russian nationwide life expectancy indicator is made up of indicators in different regions, which in 2017 vary from 66 years in Chukotka Autonomous Okrug and the Republic of Tuva to almost 82 years in the Republic of Ingushetia. Accordingly, one of the most important conditions for achieving the goals set in the field of life expectancy of the Russian population is to reduce regional differentiation by pulling lagging regions to the level of leaders.

The goal of this article is to assess changes in the regional differentiation of life expectancy of Russians for 2003−2017; the paper also investigates the level and growth of life expectancy, gender differences in the indicator, the differences between urban and rural areas, the structure of mortality due to causes, infant mortality in the regions of Russia; we also point out regional reserves for further growth in life expectancy of Russians.

Main approaches to the study of regional convergence/divergence of life expectancy

Stability of development of any system is defined by balance of dynamics of its separate components. Significant regional differentiation in terms of demographic indicators is an obstacle to the demographic development of the country and the implementation of the state demographic policy, thus it is necessary to study it. The study of demographic convergence/divergence, i.e. reduction/increase in the contrast of the distribution of indicators between regions is also important for demo-graphic forecasting, which in a country with a huge territory and diverse socio-economic and climatic conditions should be based on stable trends determined by the consistency of changes occurring in different regions [4].

The theoretical understanding of the phenomenon of demographic convergence and the coherent trajectory of development of countries and regions is presented in the works of the founders of the concepts of the first and second demographic transition [5, 6, 7, 8]. The fundamental basis for explaining the dynamics of life expectancy and the impact of various groups of factors on it is A. Omran's theory of epidemiological transition, which can be considered part of the demographic transition [9] and which was developed in the works of other authors, including domestic ones [10, 11, 12, 13, 14]. Practical studies are devoted to the convergence/divergence of countries and regions in terms of life expectancy [15, 16, 17], as well as changes in the differentiation of mortality in different population groups [18].

In Russia, mortality and life expectancy in the regional context are most often investigated at the level of individual constituent enities [1, 19, 20] or groups of territories [21, 22, 23, 24] in comparison with the national level. There are studies devoted to the comparative analysis and typology of Russian regions according to the structure of mortality and the level of life expectancy [25, 26, 27, 28, 29]. However, in our opinion, the topic of the article becomes even more relevant due to the lack of works devoted to the convergence/divergence of the Russian regions in terms of life expectancy and their comprehensive comparative analysis of the level and growth rate of the indicator, its gender and inter-settlement differentiation, the structure of mortality by causes and the magnitude of infant mortality, in light of the goals to increase the life expectancy of Russians.

Convergence/divergence of the processes under consideration is studied with the help of a whole range of differentiation indicators. Studies that use statistical tools for convergence analysis are mainly related to the study of the economic sphere of society. In the field of demography, this tool is rarely used [4]. The most well-known and easily applied technique is σ-convergence [30], which will be used in our study.

Results of the assessment of changes in regional differentiation

In 2003, in 57 RF constituent entities and in the Republic of Crimea, life expectancy was lower than the Russian average (64.8 years); life expectancy was higher than the national average in 26 regions and in Sevastopol[3]. In 2017, the indicator was lower than in the whole country (72.7 years); in 55 RF constituent entities, in three regions (Chuvash Republic, Ryazan and Kirov oblasts) it is equal to the average Russian level, and it is higher than the Russian average in 27 regions[4]. That is, for 2003−2017, in the conditions of increasing life expectancy, the situation with the number of regions above and below the average Russian level has not changed fundamentally. There was only a slight decrease in the number of constituent entities with an indicator below the national average, because three regions achieved the average level.

However, during the period under consideration there was a decrease in the interregional spread of life expectancy values and consolidation of regions to the average level. In 2003, the difference between the maximum and minimum life expectancy was 20.2 years (74.4 years in Ingushetia and 54.2 in Tyva). In 2017, the minimax decreased to 15.5 years (81.6 years in Ingushetia and 66.1 years in Chukotka Autonomous Okrug) *(Tab. 1)*.

The regional convergence of Russians' life expectancy in 2003−2017 is also evidenced by the change in the standard deviation:

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n}},$$

where x_i — life expectancy in each region;
$\bar{x}$ — national Russian average value of the indicator;
n — number of regions.

The higher value of the standard deviation shows a greater diversity of regional levels of life expectancy in comparison with the national average. A lower value indicates that regional levels are more closely grouped around the average. The dispersion of Russian regions according to the value of life expectancy was 10.2 in 2003 and 5.4 in 2017. The standard deviation, respectively, decreased from 3.2 to 2.3. That is, in 2003−2017, there was a decrease in the dispersion of regions and their convergence with the average level.

Table 1. Variation in regional values of life expectancy in Russian in 2003 and 2017

Years	Minimum value, years	Maximum value, years	Difference between the maximum and minimum values, years	Difference between the maximum and minimum values, %	Ratio of the maximum value to the minimum value, fold
2003	54.2	74.4	20.2	37.3	1.37
2017	66.1	81.6	15.5	23.4	1.23
Sources: http://www.gks.ru, https://russia.duck.consulting/maps/96/2003, http://crimea.gks.ru, http://sevastopol.gks.ru					

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[3] https://russia.duck.consulting/maps/96/2003; http://crimea.gks.ru; http://sevastopol.gks.ru
[4] http://www.gks.ru

With the help of the principle of arranging the regions into one-year groups according to the range of life expectancy in 2003 and 2017, which is the same with respect to the average Russian level, we allocated nine groups: very high life level, high level, significantly above the national average, above the national average, national average, below the national average, significantly below the national average, low level, and very low level of life expectancy *(Tab. 2, Fig. 1)*.

As we can see, the regional convergence of life expectancy in the conditions of growth in 2004–2017 occurred at the expense of extreme groups, and primarily due to the improvement of the indicator in lagging regions, i.e. regional convergence has a catching up nature:

– the number of RF constituent entities with very low and low levels of life expectancy decreased from 26 to 12 – more than twice;

– the number of regions with life expectancy that is very high, high and significantly above the average decreased from 18 to 10 – not so much;

– due to this "counter shift", there was a significant increase in the composition of the groups with levels below the national average (from 8 to 25) and significantly below the national average (from 8 to 13) – in general, the number of entities in these two groups increased from 16 to 38;

– the total number of regions with the average Russian level of life expectancy and with the level above the national average has not changed, it is 25 in 2003 and in 2017.

It is obvious that in 2004–2017 the relatively easy-to-implement reserves for increasing life expectancy, which are typical of regions with a low level of the indicator, were well used. And in regions with high life expectancy, further growth is a very difficult task, as opportunities have largely been implemented.

In each group of regions, we analyzed the features of life expectancy growth in 2003–2017 and growth reserves, which are due to factors lying on the surface and available from official statistics. Let us call them growth factors of the first order. In their composition, we consider

Table 2. Grouping of Russian regions in relation to the average Russian level of life expectancy in 2003 and 2017

2003			2017		
Group	Number of regions		Group	Number of regions	
Very high level (68.3 years and more)	7	18	Very high level (76.2 years and more)	3	10
High level (67.3-68.2 years)	6		High level (75.2-76.1 years)	4	
Significantly above the national average level (66.3-67.2 years)	5		Significantly above the national average level (74.2-75.1 years)	3	
Above the national average level (65.3-66.2 years)	14	25	Above the national average level (73.2-74.1 years)	13	25
National average level (64.3-65.2 years)	11		National average level (72.2-73.1 years)	12	
Below the national average level (63.3-64.2 years)	8	16	Below the national average level (71.2-72.1 years)	25	38
Significantly below the national average level (62.3-63.2 years)	8		Significantly below the national average level (70.2-71.1 years)	13	
Low level (61.3-62.2 years)	12	26	Low level (69.2-70.1 years)	8	12
Very low level (under 61.2 years)	14		Very low level (under 69.1 years)	4	

Regional differentiation of life expectancy in Russia in 2003 and 2017

2003

2017

Life expectancy level
- Very high
- High
- Significantly above the national average
- Above the national average
- National average
- Below the national average
- Significantly below the national average
- Low
- Very low
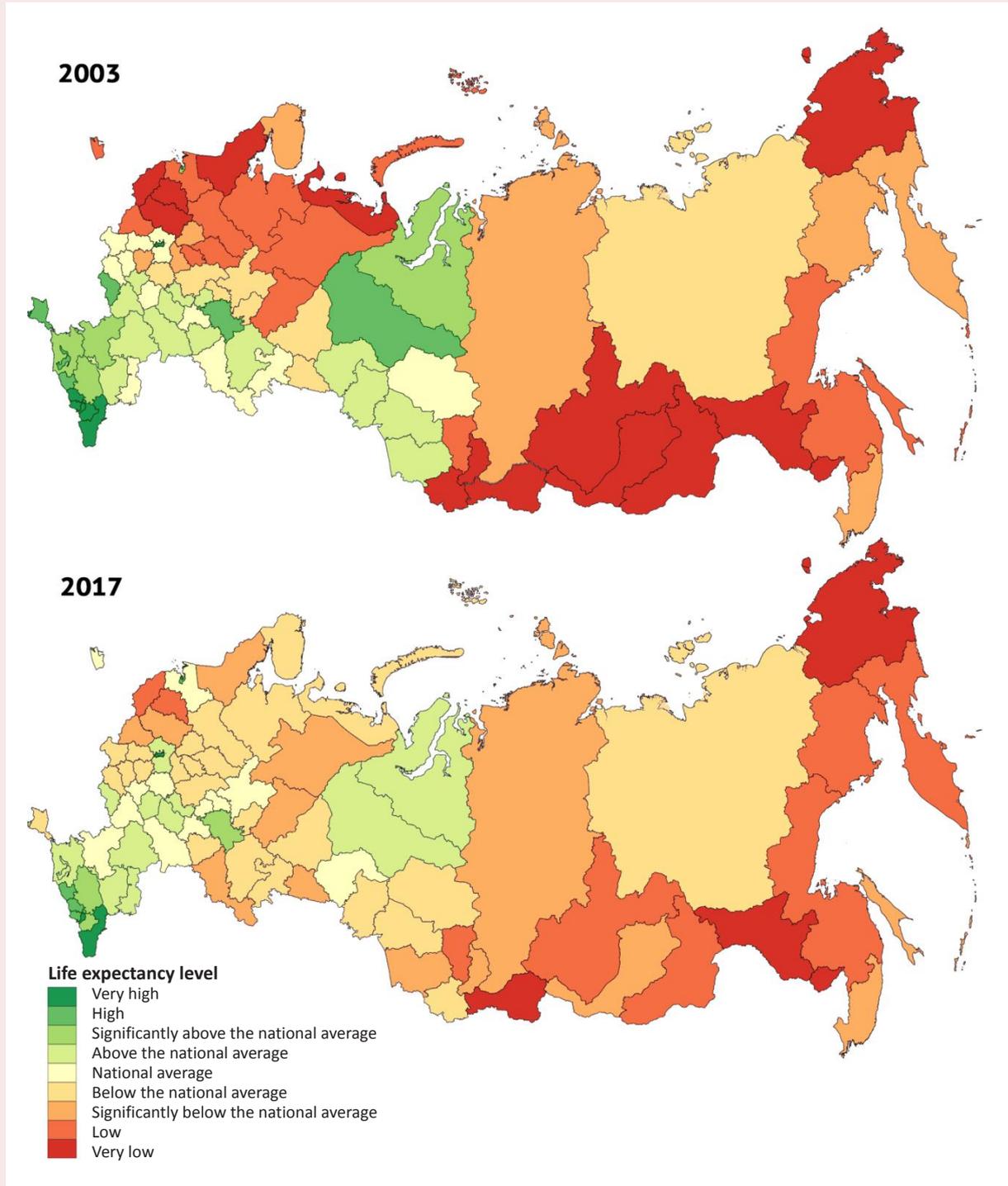
the size of the lag in the indicator for men, the differences between urban and rural areas, the share of mortality due to external causes, the level of infant mortality − in comparison with the national average.

Obviously, the regions with the most unfavorable level of life expectancy have the greatest reserves for growth due to the first-order factors, so we start the analysis of the groups from the bottom.

1. *Very low level of life expectancy*

Very low life expectancy up to 69.1 years is observed in four regions in 2017: Chukotka Autonomous Okrug, the Republic of Tyva, the Jewish Autonomous Oblast and the Amur Oblast. In 2003, all these constituent entities also belonged to the group with a very low level of life expectancy, which at that time consisted of the regions with an indicator up to 61.2 years and included 14 regions.

The Republic of Tuva, which occupied the lowest position in 2003, experienced a very significant increase in the indicator (by 12.1 years) in 2003−2017, and it lost the last position to Chukotka Autonomous Okrug. Both Chukotka and Tyva are distinguished by a very significant lag in the indicator of life expectancy and a huge, almost a quarter, share of mortality from external causes, which is also high in the Amur and Jewish oblasts. In addition to the Amur Oblast, which is characterized by low mortality in children under 12 months of age, the other three regions have the highest levels of infant mortality in the country. Significant reserves for the growth of life expectancy are also provided by the gender differentiation of the indicator, which, with the exception of that in the Republic of Tyva, significantly exceeds the average Russian level.

2. *Low level of life expectancy*

In eight RF constituent entities, life expectancy in 2017 ranges from 69.2 to 70.1

years. According to our classification, these are regions with a low level of the indicator. In 2003, a similar group included 12 regions with life expectancy from 61.3 to 62.2 years.

In most of the territories of this group (in Khabarovsk and Zabaikalsky krais, the Pskov, Novgorod and Irkutsk oblasts), the increase in life expectancy in 2003−2017 exceeds the national average, the indicator in the Kemerovo Oblast is almost at the national average level. The Kemerovo Oblast and Khabarovsk Krai in 2003 still belonged to the group with a low level of life expectancy; Zabaikalsky Krai, the Pskov, Novgorod and Irkutsk oblasts moved here from the group with a very low level. In contrast to the above six regions, in the Magadan Oblast and in Kamchatka Krai, the increase in life expectancy in 2003−2017 was significantly lower than the national average − these two constituent entities during the period under consideration moved away from the group with a more prosperous situation.

Almost all regions in the group with a low level of life expectancy are characterized by a rather significant gender differentiation of the indicator; it does not exceed the average Russian level only in Kamchatka and Zabaikalsky krais. The difference between urban and rural indicators of life, with the exception of the Novgorod and Kemerovo oblasts, is much larger than the Russian average. Almost everywhere the share of mortality from external causes is high, the only exception is the Novgorod Oblast. In addition to the Magadan and Pskov oblasts, infant mortality rate is higher than the Russian average indicator. That is, in this group of regions, despite a fairly significant increase in life expectancy, there are still significant reserves that depend on the structure of mortality due to causes, lagging of rural indicators and indicators for men, and an insufficient control over infant mortality.

3. *Life expectancy significantly below the national average*

In 13 Russia's constituent entities, life expectancy ranged from 70.2 to 71.1 years in 2017. This is a group of regions in which the level of the indicator is significantly below the national average. In 2003, the corresponding group included eight regions with life expectancy in the range of 62.3–73.2 years.

The expansion of the group was largely due to the fact that it included previously lagging territories. In the republics of Karelia, Komi, Buryatia and Khakassia, in Perm and Krasnoyarsk krais, in the Tver, Smolensk and Sakhalin oblasts in 2003–2017 there was a more significant increase in life expectancy than in Russia as a whole; and in Altai and Primorsky krais, in the Orenburg and Kurgan oblasts, the level was below average. The republics of Karelia, Buryatia and Khakassia and the Tver Oblast have improved their ranking positions in the period under review, having moved here from the bottom group with a very low level of life expectancy, skipping the group with a low level. The Republic of Komi, Perm Krai, the Smolensk and Sakhalin oblasts moved above from the group with a low level. Krasnoyarsk and Primorsky krais in 2003 belonged to the group of regions with the level of life expectancy significantly below the national average. The Kurgan Oblast moved here from the group of regions with the more prosperous situation; in 2003, the Orenburg Oblast belonged to the regions with the average level of life expectancy, and Altai Krai was in the group with life expectancy above the national average. That is, the specified constituent entities in the conditions of growth of life expectancy in Russia worsened their ranking positions very significantly.

All regions within this group are characterized by an increased gender differentiation of life expectancy and, except for the Orenburg and Tver oblasts, have a strong lag in the rural indicator. Only in Karelia, Altai Krai, and in the Tver and Smolensk oblasts, the share of external causes of death is insignificant. The situation with unnatural causes of death is also more or less favorable in the Orenburg Oblast and Primorsky Krai. In the remaining seven regions, they represent a significant reserve for life expectancy growth. Also, seven regions of the group — more than half — have the infant mortality rate above the average in Russia (except for the republics of Komi and Khakassia, Perm Krai, the Kurgan, Tver and Sakhalin oblasts). Thus, this group of regions has significant reserves due to gender differentiation, lag in the rural indicator, unfavorable structure of mortality due to causes, and increased infant mortality.

4. *Life expectancy below the national average*

The largest group of Russian regions — 25 constituent entities — is characterized in 2017 by the indicator of life expectancy from 71.2 to 72.1 years. This level is below the national average. In 2003, a similar group included only eight regions with a life expectancy of 63.3–64.2 years.

The increase in this group by more than three times — by 17 regions — occurred both from the bottom and from the top. About half of the regions in this group (the republics of Udmurtia and Altai, Nenets Autonomous Okrug, the Yaroslavl, Arkhangelsk, Nizhny Novgorod, Kostroma, Murmansk, Ivanovo, Vologda, Vladimir and Tula oblasts) experienced an increase in life expectancy above the national average in 2003–2017. Nenets AO and the Altai Republic changed their ranking positions very much during this time; they moved into this group from the bottom group and skipped two intermediate groups at the same time. The Arkhangelsk, Kostroma, Ivanovo and Vologda

oblasts moved here from the group with low life expectancy, skipping one group. The Tula, Vladimir, Murmansk and Yaroslavl oblasts moved here from the group with life expectancy significantly below the national average. In 2003, the republics of Udmurtia and Sakha (Yakutia), as well as the Nizhny Novgorod and Sverdlovsk oblasts were still in the group of regions with the indicator below the national average.

At the same time, in the Sverdlovsk Oblast and the Republic of Sakha (Yakutia), as well as in the republics of Crimea and Bashkortostan, the Tomsk, Kaluga, Kursk, Samara, Orel, Novosibirsk, Chelyabinsk, Omsk and Bryansk oblasts, the increase in life expectancy for 2003–2017 is less than in Russia as a whole. The Kursk, Orel, Chelyabinsk, Tomsk, Kaluga and Bryansk oblasts moved into this group from the group of regions with the average Russian level. The Republic of Bashkortostan, the Omsk, Novosibirsk and Samara oblasts moved to this group from the group with a level above the national average, skipping the group with the national average level. And the Republic of Crimea, with the 4.2 years increase in the indicator for the period, moved here from the group of regions with a high level of life expectancy

Almost all regions in this group (except the Crimea and the Murmansk Oblast) are characterized by a noticeable lag in this indicator. But in many of them, for example in Yakutia, the Yaroslavl, Nizhny Novgorod, Kostroma, Vologda, Vladimir, Tula and Samara oblasts there is a slight lag in the indicator for men. In 2016, in the Crimea, the Murmansk, Ivanovo and Kaluga oblasts, it exceeds the urban indicator, which proves the absence of a fundamental difference between the city and the village and can be considered by other regions as a positive experience in addressing the issue of rural lag in life expectancy.

All Northern regions within this group (Yakutia, Nenets Autonomous Okrug, the Murmansk and Arkhangelsk oblasts), as well as the republics of Udmurtia, Bashkortostan and Altai, the Samara, Sverdlovsk, Chelyabinsk, Omsk and Tomsk oblasts are characterized by a high share of mortality from external causes. In 12 regions of the group, infant mortality exceeds the national average, while in the Republic of Altai, the Bryansk and Kostroma oblasts, Altai Krai and Bashkiria — this indicator is considerably high. Thus, in the regions of this group, significant reserves for further growth of life expectancy consist primarily in reducing the gender differentiation of the indicator, reducing the share of mortality from external causes and infant mortality rate.

5. *National average level of life expectancy*

In 12 constituent entities of the Russian Federation, life expectancy in 2017 was in the range of 72.2–73.2 years, which can be considered the average Russian level. In 2003, this group included 11 regions with life expectancy of 63.3 to 65.2 years.

With an almost constant number of regions, the group with the average Russian level of life expectancy has been almost completely updated (only one region out of 12 was in this group in 2003 and in 2017) by including regions both from the bottom and from the top. The number of regions that entered this group from the top is more significant. The Republic of Mari-El, the Ryazan, Kirov and especially Kaliningrad and Leningrad oblasts are characterized by a significant increase in the indicator for 2003–2017. The Kaliningrad and Leningrad oblasts rose to this group from the group with low life expectancy, having skipped two groups. The Republic of Mari-El, the Ryazan and Kirov oblasts moved into this group from the group with an indicator below the national average. In Chuvashia, the Tyumen, Voronezh, Rostov, Saratov, Lipetsk and Ulyanovsk oblasts, we

observe the increase in life expectancy from 6.7 to 7.6 years (with the Russian national average increase of 7.9 years). Of these, the Ulyanovsk Oblast in 2003 had the average Russian level of life expectancy. Chuvashia, the Tyumen, Voronezh, Saratov and Lipetsk oblasts worsened their positions during the period under consideration: they moved into this group from the group with an indicator above the national average. And the Rostov Oblast moved here from the group with a level significantly above average, skipping one group.

Regions of the group, except the Tyumen, Rostov, Saratov and Kaliningrad oblasts, are characterized by increased gender differences. More than half of them are characterized by a noticeable lag in the rural indicator. In the Ryazan, Voronezh, Saratov and Rostov oblasts, inter-settlement differences are lower than the average Russian level; and in the Leningrad Oblast, the ratio in 2016 is the opposite: the rural indicator exceeds the urban one. Chuvashia and Mari-El, the Voronezh, Tyumen, Leningrad and Kirov oblasts are characterized by a high proportion of external causes of death, representing a significant reserve for mortality reduction. In the Rostov Oblast, the infant mortality rate is significantly higher than the national average. Thus, in the regions of the group with the average Russian level of life expectancy, there are significant reserves for further growth, especially due to the alignment of gender differences and the increase in the rural indicator.

6. *Life expectancy above the national average*

In 2017, 13 Russia's constituent entities belonged to the group with the level of life expectancy from 73.2 to 74.1 years. In 2003, there were 14 regions with the indicator in the range of 65.3–66.2 years, which at that time was above the national average.

In the Astrakhan, Moscow and Tambov oblasts, the increase in life expectancy for 2003–2017 is greater than the national average. These regions have moved up to the considered group from the group of regions with the average Russian level of life expectancy. The Penza Oblast has the average Russian value of the growth rate. In 2003, like the Volgograd Oblast and the republics of Mordovia and Kalmykia, it belonged to the group of regions with life expectancy above the national average. The remaining six regions in this group worsened their positions during the period under consideration. Krasnodar Krai and Yamalo-Nenets Autonomous Okrug moved down to this group from the group with life expectancy significantly above average; the Belgorod Oblast, Adygea Republic and Khanty-Mansi Autonomous Okrug – from the group with a high level of life expectancy, the city of Sevastopol with the growth of 3.7 years – from the group with a very high level. As we can see, new regions moved to the group of regions with a life expectancy above the national average to a greater extent from the top, i.e. at the expense of a reduction in the growth rate of the indicator when it reached a high value.

The regions in this group are mainly characterized by a less noticeable lag in the indicator for men. Gender differentiation is greater than the national average only in the Republic of Mordovia and in the Penza and Tambov oblasts. In most regions, there is a slight lag in the rural indicator, and it exceeded the urban level in the Moscow Oblast, Krasnodar Krai and Sevastopol in 2016. But in the republics of Adygea and Mordovia, and in Khanty-Mansi and Yamalo-Nenets autonomous okrugs, life expectancy of the rural population is significantly lower than in urban areas. In Yamalo-Nenets and Khanty-Mansi autonomous okrugs, as well as in Kalmykia,

a significant reserve for further increase in life expectancy can be found in the decrease in mortality from external causes. The infant mortality rate exceeds the national average in the Astrakhan Oblast, in Adygea and in Yamalo-Nenets Autonomous Okrug.

7. Life expectancy significantly above the national average

In 2017, three Russian constituent entities belonged to the group of regions with the value of 74.2–75.1 years. In 2003, the group with life expectancy significantly higher than the national average included five regions with the indicator ranging from 66.3 to 67.2 years.

All regions in this group are characterized by an increase in life expectancy below the national average. Stavropol Krai in 2003 belonged to this group; the Republic of Tatarstan moved down to this group from the group with a high level of life expectancy of the population, the Chechen Republic – from the group with a very high level. That is, the replenishment of the group occurs from above due to the slowdown in the growth rate of life expectancy when high levels are reached. In Stavropol Krai and especially in Chechnya, gender differences are much smaller than in Russia as a whole, in Tatarstan – only slightly more. The difference between the city and the village in Tatarstan is at the average Russian level, in Stavropol Krai – slightly higher; the ratio is the opposite in the Chechen Republic: the indicator in rural areas in 2016 is significantly higher than the urban one. In all regions of the group, the proportion of mortality from external causes is below the national average. However, in Chechnya and especially in Stavropol Krai, the infant mortality rate is quite high. Thus, in the regions of this group there are obvious reserves for further increase in life expectancy: in Chechnya and in Stavropol Krai, the reserves include a decrease in the

mortality in children under 12 months of age, in Tatarstan – a reduction in the lag of the indicator for men.

8. High level of life expectancy

The group with a high level of life expectancy ranging from 75.2 to 76.1 years in 2017 includes four constituent entities of Russia. In 2003, six regions were included in the corresponding group, which covers territories with the indicator level in the range from 67.3 to 68.2 years.

Saint Petersburg had an increase in life expectancy above the national average and moved upward in this group from the group of regions with an indicator significantly higher than the national average. The Karachay-Cherkess Republic traditionally belongs to the group with a high level of life expectancy. Kabardino-Balkaria and North Ossetia-Alania moved down to this group in 2003–2017 from the group with a very high level.

All regions in this group have a relatively favorable level of gender differentiation of the indicator and the differences between the city and the village, especially in Kabardino-Balkaria (as for Saint Petersburg, there is no rural population there), the percentage of mortality from external causes is significantly lower. With the exception of Karachay-Cherkessia, the infant mortality rate is lower than the national average. But, despite the fact that the indicator for men is not lagging behind very much, the magnitude of gender differences still makes it possible to consider them as a significant reserve for increasing life expectancy.

9. Very high level of life expectancy

The group that is conditionally called "very high level of life expectancy" in 2017 included three RF constituent entities with the level of 76.2 years and above: Ingushetia, Moscow and Dagestan. In 2003, this group included seven regions with life expectancy of 68.3 years.

All three regions traditionally belong to this group. Even in 2003, they occupied the top three places in the rating of Russian regions in terms of life expectancy. Only Dagestan and Moscow changed places during the period under consideration, since Moscow is characterized by the average Russian level of growth, whereas the growth was below the national average in Dagestan, as in Ingushetia, in 2003−2017. Gender differentiation is favorable in all regions, virtually like in the industrialized countries where it ranges from 5 to 8 years and increases as compared to the difference caused by medical and genetic factors, due to a reduction in female mortality in terms of gender equality and the fact that most women receive regular medical supervision and service [31, p. 88]. But this group of territories also has reserves for the growth of the first order. In particular, all of them have an increased level of infant mortality, especially Dagestan and Ingushetia, and Dagestan also has a noticeable lag in the rural indicator.

Concluding our analysis of the changes in regional differentiation of life expectancy of Russians for 2003−2017 we summarize the existing reserves for the growth of the indicator due to the first-order factors in regions; it will allow us to identify groups of territories that require similar tasks to be addressed so as to increase the level of life expectancy further *(Tab. 3)*.

In 59 constituent entities of Russia, the excess of female life expectancy is higher than the national average, and this fact requires closer attention to the following issues:

Table 3. Regional reserves of growth of life expectancy due to the potential of factors of the first order in 2017

Growth reserves	Number of regions	Regions
Significant gender differentiation in life expectancy	59	Republics of Altai, Bashkortostan, Buryatia, Karelia, Komi, Mari-El, Mordovia, Sakha (Yakutia), Tatarstan, Udmurtia, Chuvashia and Khakassia; Altai, Zabaikalsky, Kamchatka, Krasnoyarsk, Perm, Primorsky and Khabarovsk krais; the Amur, Arkhangelsk, Bryansk, Vladimir, Vologda, Voronezh, Ivanovo, Irkutsk, Kaluga, Kemerovo, Kirov, Kostroma, Kurgan, Kursk, Leningrad, Lipetsk, Magadan, Nizhny Novgorod, Novgorod, Novosibirsk, Omsk, Orenburg, Orel, Penza, Pskov, Ryazan, Samara, Sakhalin, Sverdlovsk, Smolensk, Tambov, Tver, Tomsk, Tula, Ulyanovsk, Chelyabinsk and Yaroslavl oblasts, Nenets and Chukotka autonomous okrugs; the Jewish Autonomous Oblast
Significant lag in life expectancy of the rural population	47	Republics of Adygea, Altai, Bashkortostan, Buryatia, Dagestan, Karelia, Komi, Mari-El, Mordovia, Tatarstan, Tyva, Khakassia and Chuvashia; Altai, Zabaikalsky, Kamchatka, Krasnoyarsk, Perm, Primorsky, Stavropol and Khabarovsk krais; the Arkhangelsk, Bryansk, Irkutsk, Kaliningrad, Kirov, Kurgan, Kursk, Lipetsk, Magadan, Novosibirsk, Omsk, Orel, Pskov, Sakhalin, Sverdlovsk, Smolensk, Tomsk, Tyumen, Udmurt, Ulyanovsk and Chelyabinsk oblasts; Nenets, Khanty-Mansi, Chukotka and Yamalo-Nenets autonomous okrugs; the Jewish Autonomous Oblast
Large share of external causes of death in the structure of mortality due to causes	42	Republics of Altai, Bashkortostan, Buryatia, Komi, Kalmykia, Mari-El, Sakha (Yakutia), Tyva, Udmurtia, Khakassia and Chuvashia; Zabaikalsky, Kamchatka, Krasnoyarsk, Perm, Primorsky and Khabarovsk krais; the Amur, Arkhangelsk, Voronezh, Irkutsk, Kemerovo, Kirov, Kurgan, Leningrad, Magadan, Murmansk, Omsk, Orenburg, Penza, Pskov, Samara, Sakhalin, Sverdlovsk, Tomsk, Tyumen and Chelyabinsk oblasts, Nenets, Khanty-Mansi, Chukotka and Yamalo-Nenets autonomous okrugs, the Jewish Autonomous Oblast
High infant mortality rate	38	Republics of Adygea, Altai, Bashkortostan, Buryatia, Dagestan, Ingushetia, Karachay-Cherkessia, Karelia, Tyva and Chechen Republic; Altai, Zabaikalsky, Kamchatka, Krasnoyarsk, Primorsky, Stavropol and Khabarovsk krais; the Arkhangelsk, Astrakhan, Bryansk, Vologda, Irkutsk, Kemerovo, Kostroma, Novgorod, Omsk, Orenburg, Orel, Rostov, Smolensk, Tula, Chelyabinsk and Yaroslavl oblasts; Nenets, Chukotka and Yamalo-Nenets autonomous okrugs, the Jewish Autonomous Oblast; the city of Moscow

unhealthy lifestyle of men, especially in working age, gender differences in behavioral risk of industrial, domestic and road injuries, and prevention of risky behavior. In 47 regions, there is a significant lag in the rural indicator, suggesting that it is necessary to focus on improving sanitary and living conditions in rural areas, the living standards of rural residents and their access to quality medical services. Almost half of the regions (42) have a significant proportion of mortality from unnatural causes, which is based on both behavioral and environmental risk factors: unfavorable moral, psychological and criminal atmosphere, low standard of living and unhealthy lifestyle, insufficient level of safety of working conditions, recreation and movement. In 38 regions, the infant mortality rate remains high, depending both on the quality of healthcare and maternity services, and on the well-being in the lifestyle of people, in the development of marriage and family relations and family life. At the same time, 14 regions (the republics of Altai, Bashkortostan and Buryatia, Zabaikalsky, Kamchatka, Krasnoyarsk, Primorsky and Khabarovsk krais, the Arkhangelsk, Omsk and Chelyabinsk oblasts, Nenets and Chukotka Autonomous okrugs, the Jewish Autonomous Oblast) are included in all the groups; that is, they have all reserves of growth of the first order.

Conclusion

Thus, in the conditions of growing life expectancy of Russians there was a noticeable rapprochement of Russia's constituent entities and their consolidation to the average level. Regional convergence occurred at the expense of the extreme groups according to the level of the indicator, and primarily due to the fact that lagging regions improved their positions; it means that we find out a catching up

convergence of life expectancy in Russia in 2003—2017, this fact determines the scientific novelty of our study. It is obvious that for 2004—2017, the relatively easy-to-realize life expectancy reserves that are typical of low-income regions have been well used. And in regions with high life expectancy, further growth is already a very difficult task, since the possibilities of first-order factors, which are considered as the magnitude of gender differences, the difference between urban and rural indicators, the share of mortality from external causes of death and the level of infant mortality, have already been implemented considerably.

However, all the selected nine groups of Russian regions still have reserves to increase life expectancy, due to certain first-order growth factors. Obviously, regions with the most unfavorable level of the indicator have the largest reserves. But also in the group with very high life expectancy, the lag of the rural indicator and the value of infant mortality provide opportunities for further increase in life expectancy due to growth factors of the first order.

But even when the possibilities of factors of the first order are exhausted, there still remains the potential for increasing life expectancy determined by the increase in the standard of living and quality of life, reduction in social differentiation, increased motivation for healthy lifestyle, formation of responsible attitude of citizens of all ages to their health, prevention of major modifiable risk factors for chronic diseases, early detection and adequate treatment of identified diseases, development of and improving access to high-tech medicine, etc. Promotion and utilization of all reserves is an important condition for further growth of life expectancy of Russians.

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