Population Dynamics in Russia in the Context of Global Trends

E. M. Shcherbakova

a Institute of Economic Forecasting, Russian Academy of Sciences, Moscow, 117418 Russia
b National Research University Higher School of Economics, Moscow, 109028 Russia

* e-mail: escherb@yandex.ru

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Abstract—The article examines the current demographic trends in Russia as compared to population changes in the world and its major regions based on data from the Russian Federal State Statistics Service (Rosstat), Eurostat, and the UN Population Division. It is shown that in terms of a number of characteristics of population reproduction—low fertility, ageing population structure, natural population decline—Russia is quite similar to the developed countries group. However, Russia is behind many countries in reducing the mortality rate of the middle-aged and older population, especially in men, and, correspondingly, in life expectancy for all age groups, which results in a noticeable increase in natural population decline and in deformation of the sex structure of the population. The specifics of the age structure of the Russian population that have been formed by a number of demographic waves are such that changes in the number of births and in age group sizes come in waves; this trend will continue in the coming decades. The article also analyzes excess mortality in Russia during the COVID-19 pandemic in comparison with similar data for the European Union (EU-27) and compares healthy life expectancy estimates for Russia, the entire world, individual countries, and different groups of countries by income.

Keywords: Russia, population growth, natural population decline, migration-based population growth, population ageing, fertility, life expectancy

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Introduction. Analyzing and forecasting demographic trends is the constant focus of attention of researchers of demographics and other related disciplines. Forecasting changes in the size and structure of the population is a necessary component of economic and social forecasts. Some demographic characteristics serve as important indicators of socioeconomic well-being (infant mortality, life expectancy) and are included, for example, in the human potential index. Population decline, which has become a stable trend in Russia, is cause for serious concern, and that incentivizes research into possible ways to save the population [1–3] and restore its well-being [4, 5]. Demographers first raised the alarm about the threat of depopulation back in the 1970s, when the fertility dropped to an extremely low level that could not ensure simple generation replacement [6]. Extensive discussions of demographic challenges and risks for socioeconomic development continued in the following years [5, 7–9].

The demographic situation in Russia is constantly monitored by various research centers. The most long-standing records are the annual Naselenie Rossii (Population of Russia) reports that in 1993–2006 were issued by the Center for Demography and Human Ecology of the Institute of Economic Forecasting of the Russian Academy of Sciences and are now (since 2007) issued by the Vishnevsky Institute of Demography of the Higher School of Economics.1

When analyzing demographic trends, researchers often use cross-country comparisons to substantiate their interpretations and forecasts. Entire separate research areas are dedicated to global demographic shifts [8, pp. 299–362], demographic problems of the global North and South [10], changes in the global population structure that are associated with risks of aggravation of the problems of coexistence of civilizations whose differences lie more in their religious and cultural mindsets than in economics or political regimes [11].

It seems worthwhile to analyze the population dynamics in Russia in the context of global trends, thereby identifying the country’s place in the global population and deviations of its key indicators of population reproduction from the global average. These

1 The reports for 1999–2018 are available at http://www.demo scope.ru/weekly/knigi/books.php (Date accessed: February 28, 2022).
comparisons will be based on data from the Russian Federal State Statistics Service (Rosstat) and estimates used in the UN system of organizations that have since 1950 been regularly issued by the Population Division of the UN Department of Economic and Social Affairs. The results of the last completed, 26th cycle of calculations were presented in the summer of 2019 [12] and therefore do not account for the impact of the COVID–19 pandemic.

The long-term trend of natural population decline and reduction of the population size in Russia. The trend of population decline has been observed in Russia since 1993, when the number of Russian residents reached its maximum value of 148.6 million people. In 2009–2017, the trend was interrupted by moderate growth, but in 2018 the decline resumed. According to Rosstat, on January 1, 2022, the population of Russia was 145.6 million people, having decreased since the beginning of 2021 by 612.8 thousand people, or 0.4%.

The main reason for the population decline is the fact that the fertility consistently remains at below-replacement level, leading to natural decline. The number of deaths in Russia has been exceeding the number of births since 1992. The situation was the most acute in 1999–2002, when natural decline reached almost a million people per year (the highest value was 959 thousand people, or 6.6‰ which was recorded in 2000). Although the rate of the decline decreased in subsequent years and in 2013–2016 there even was a small natural increase, after that the number of deaths began to exceed the number of births once again. Due to the COVID–19 pandemic, in 2020 the natural population decline was more than double that of 2019, 702 thousand people, or −4.8‰. In 2021, it increased to 1043 thousand people, or −7.2‰, surpassing the 2000 value.

In the context of the steady and long-term natural decline trend, the decisive factor of population changes in Russia is migration-based growth. Since 1993, it has become virtually the only factor of population growth in Russia (with the exception of 2013–2016), partially compensating for the natural decline and in some years leading to overall population growth (1994, 2009–2017).

Overall, between 1993 and 2021 the population of Russia (excluding Crimea) decreased by 15.4 million people due to natural decline and increased by 10.0 million people due to net-migration.

All realistic forecasts predict that the trend of natural population decline will continue in the coming years: according to the average and low versions of the Rosstat forecast, it will continue for the next 15 years, according to UN prospects [12], until 2050, although the intensity will vary.

Russia is far from the only country with population dynamics defined by the persistent below-replacement fertility. In the future, the trend long-term of natural population decline is expected to spread to more and more countries.

According to UN estimates [12], in the second half of the 20th century natural population decline was first recorded in 1970–1975 in Germany and Luxembourg; in Germany, the trend persists to this day. In subsequent years, the number of countries characterized by such decline increased to four, in 1990–1995 to thirteen, most of these countries being European. In some periods the group was joined by countries that had suffered significant losses as a result of genocide a population group (Cambodia in 1975–1980, Rwanda in 1990–1995), but in these countries the natural decline trend did not become long-term. In 2015–2020 the number of countries characterized by natural population decline increased to 23, and in the medium term their number is expected to continue to increase at an accelerated pace, since the birth rate is declining in most countries where it used to be high, and in some cases the decline is rapid (Iran, Ireland). The key reasons for this decline are the inverse correlation of the fertility level and the country’s levels of well-being, education, and women’s economic participation.

But even in comparison with the growing number of (mostly developed) countries characterized by natural population decline, in Russia in some periods this process is particularly intense, despite partial compensation by net-migration. Since the middle of the 20th century, the average annual population growth rate in Russia has been lower than the global average and closest to the indicators of the developed countries category (Fig. 1). However, while for this group of countries the trend is a gradual decline in population

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2 Sotsial’no-ekonomicheskoe polozhenie Rossii. Yanvar’ 2022 goda. (Socioeconomic Situation in Russia. January 2022), Moscow: Federal State Statistics Service, 2022, p. 257.

3 Per 1000 resident population members.

4 Excluding the population of Crimea. With Crimea, the number of births exceeds the number of deaths in only three years (2013–2015).

5 Predpolozhitel’naya chislennost’ naseleniya Rossiiskoi Federatsii do 2035 goda: Stat. byull. (Estimated Population Size of the Russian Federation until 2035: Statistical Bulletin), Moscow: Federal State Statistics Service, 2020; Rossiiskii statisticheskii ezhegodnik. 2020: Stat. sb. (Russian Statistical Yearbook, 2020), Moscow: Federal State Statistics Service, 2020.

6 In UN publications the concepts of “developed” (advanced) countries and “developing” (less developed) countries are used for statistical purposes and do not always accurately reflect the progress of the country’s development since the 1960s, which is when these terms first appeared in the context of starker differences between these two groups. The developed countries group traditionally includes all countries and territories of Europe (including Russia) and North America, as well as Australia, New Zealand, and Japan; the developing countries group – all regions of Asia (except Japan), Africa, Latin America and the Caribbean, Melanesia, Micronesia, and Polynesia. Within the category of developing (less developed) countries there is a subgroup of 47 least developed countries (33 in Africa, 9 in Asia, 4 in Oceania, 1 in Latin America). See http://unohrlls.org/about-lcs/ (Date accessed: December 20, 2021).
growth rates, in Russia they changed in waves and with significant deviations from the trend.

The global population growth rate is also decreasing, but for now remains high (over 1.1% per year in 2015–2020), which is associated with risks for sustainable development [13, 14]. The share of the population of the developed countries characterized by decreased growth rates, and in the near future likely also by population decline, is steadily declining and is expected to continue declining.

Aging of the population of Russia, increase in the demographic burden of older age groups, and waveform deformations of the age structure of the population. The number of births and deaths largely depends on the age and sex structure of the population. In addition to the global trend of an increasing share of older age groups caused by the decreased fertility and increased life expectancy, the population of Russia is characterized by long-term preservation of waveform deformation of the age structure, as well as significant imbalances of the sex structure in older age groups. These deformations were caused by several demographic waves. The wave that is relevant for the current population is the replacement of sparsely populated generations born during the Great Patriotic War by populous generations of the 1950s and early 1960s. The children of the sparsely populated wartime generation were born in the second half of the 1960s and early 1970s, the grandchildren in the 1990s. The influence of this demographic wave is likely to continue until the end of this century, manifesting primarily as waveform changes in the sizes of major age groups and the numbers of births and marriages.

According to Rosstat, at the beginning of 2021 children under the age of 15 made up 17.7% of the Russian population (the lowest value, 14.8%, was observed in 2006–2007), while elderly people (65 and older) made up 15.8% (this share had once again increased since 2010, when it was 12.7%). For comparison, note that 30 years ago children under the age of 15 made up 22.7% and elderly people over 65, 10.6% of the country’s population.

Until recently, the age-dependency ratio in Russia had been decreasing, dropping from 768 people under and over the working age per 1000 working-age people in 1992 to 586 in 2007. That decrease was mainly due to a decrease in the burden of the younger age groups (from 426 to 256), while the decrease in the burden of older age groups was not significant (from 341 to 326 in 2006). After the economically favourable period known as the “demographic dividend,” the age-dependency ratio began to increase rapidly: to 830 people under (343) and over (487) the working age per 1000 working-age people. The demographic burden on the working-age population is expected to increase in the future, mainly due to the increasing number of elderly people, which creates new challenges for the development of the social protection, healthcare, and long-term care systems and increases the relevance of measures aimed at increasing active longevity.

In terms of the age structure of the population, Russia is noticeably different from both global indicators and those of the major groups of countries (Fig. 2). The age structures of the total population of the developed countries is also somewhat wavelike, but in Russia the waves are more pronounced. The structures of the broad age groups are more similar: children and young people under 20 make up 23% of the population of Russia and 22% of the population of the developed countries, elderly people 65 years and older make up 16 and 19% respectively. Nevertheless, the population of Russia is younger and its share of working-age population (20–64 years) is higher at 61% compared to 59%.

Compared to the global population and to the developing countries, the population of Russia is older. Young people under 20 make up 33% of the global population and 49% of the populations of the developing countries, while people 65 years and older make up 9 and 4% respectively.

The young age structure of the global population, especially in the least developed countries, represents a significant potential for growth that will ensure population increases in the coming decades even if the global birth rate falls to or below the level of simple population reproduction. In contrast, the older age structure of the developed countries in general and Russia specifically will slow population growth down [15, 16]. According to UN projections, in 2020–2050

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7 Chislennost’ naseleniya Rossiiskoi Federatsii po polu i vozrastu na 1 yanvarya 2021 goda. Stat. byull. (Age and Sex Structure of the Population of the Russian Federation as of January 1, 2021: Statistical Bulletin), Moscow: Federal State Statistics Service, 2021.
the inertia of the older age structure (population momentum) alone will decrease the population of Europe by 6% [13, p. 54].

**Consistently low birth rate.** In recent decades, Russia has seen alternating declines and rises in the number of births, with the downward trend being predominant. These fluctuations are associated in part with the waveform deformations of the age structure (specifically with changes in the number of women of reproductive age), in part with changes in the intensity of the fertility and its age profile.

The last observed period of increasing in the number of births occurred in 2000–2014, when the increase was almost 1.6-fold (from 1215 thousand people in 1999 to 2013 thousand people in 2014, excluding Crimea). However, this indicator remained lower than in 1971–1990 (during that period its greatest value was 2500 thousand people in 1987). Since 2015, the trend of a declining number of births has resumed. In 2021, it decreased to 1380 thousand people (1403 thousand people with Crimea), or 9.6‰, which is noticeably lower than in 2012–2015 (over 13‰).

In 1999, the total fertility rate\(^8\)—the indicator usually used as an integral characteristic of fertility, in particular for the purposes of social policy and forecast—fell to the lowest value recorded in modern Russia, 1.157. The level necessary for simple population reproduction at modern mortality rates is almost double that (conventionally taken as 2.1 children per woman).

In 2000–2015, the total fertility rate increased (with the exception of 2005), reaching 1.777 by 2015, which roughly corresponds to the level of the early 1990s, but is 15% lower than required for simple population reproduction. In 2016, the indicator started to decline again, and in 2019 it dropped to 1.504, 15% less than in 2015 and 28% lower than required for simple population reproduction. In 2020, the total fertility rate remained at almost the same level of 1.505.

Globally, the total fertility rate has decreased from about five children per woman in the 1950s and 1960s to 2.4 in 2020 (Fig. 3). In terms of this indicator, Russia is rather similar to the average for the developed countries, despite some both upward and downward deviations from the general trend.

The extremely low values of total fertility rate observed at the turn of the 20th and 21st centuries in Russia as well as almost all Eastern European countries were largely due to changes in the age profile of fertility, shifts in the calendar of births, and the increased mean age of mothers at childbirth (primarily at first birth). The average age at which Russian women gave birth increased to 28.8 years in 2020. The average age at which women had their first child increased to 25.9 years in 2018–2020. Compare this with the average age at which a mother gives birth to her first child in half of the EU-27 countries, where it is already over 29 years, and in some even over 31 years (in Italy, Spain, and Luxembourg, according to 2019 data).\(^9\)

During periods of such significant shifts in fertility rates, assessments based on calendar indicators of total fertility for individual years (for the corresponding notional generations) may not be entirely reliable [17]. Even given the same total fertility level, forecasting results significantly depend on the age profile [18]. Therefore, assessing long-term prospects requires using indicators of real generations (cohorts of certain birth years).

The completed fertility rate of generations of Russian women who have aged out of childbearing age also indicates a decrease, but a more moderate one: women born in 1960–1964 gave birth to an average of 1.76 children, women born in 1965–1969 to an average of 1.64. The future completed fertility rate of women born in 1970–1974 is estimated at 1.60, in 1975–1979 at 1.65, and in the 1980s at 1.73–1.75 children per woman [19, pp. 140–141]. The average number of births calculated for single-year generations of Russian

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\(^8\) Represents the average number of children that would be born to a woman if the age-specific fertility rates of a given year applied to the entire reproductive period of her life (conventionally at the age between 15 and 49). Its value does not depend on the age structure of the population and characterizes the average fertility rate in a given calendar period (year). This is the fertility rate of the so-called “notional generation”. Fertility rates of real generations are estimated using the completed fertility rate indicator (usually for women born during the same time period).

\(^9\) Eurostat database. Fertility indicators [demo_find]—https://ec.europa.eu/eurostat/data/database. (Date accessed: January 18, 2022).
women born in 1960–1980 varies within approximately the same range: from 1.58 children per woman born in 1973 to 1.86 per woman born in 1960 [5, p. 53].

In general, fertility rates for both notional and real generations in Russia show a tendency to stabilize at the average level typical of advanced economies [19, pp. 155–162; 20, pp. 148–153]. For the entire period since 1960, the total fertility rate in Russia has varied within the minimax limits of this indicator’s variation in the developed countries, which in the last two decades ranged from 1.3 to 2.1 births per woman. Decreases in the total fertility rate of real generations were observed during this period in all developed countries, and only in a few such countries it still exceeds the level required for simple population reproduction in generations that have recently completed the reproductive cycle (in the 1965–1969 birth year cohorts in New Zealand, Macedonia, Ireland, and the United States). In Russia the completed birth rate dropped below replacement level as early as in the 1955–1959 birth year cohorts.

**Lag in life expectancy.** In the conditions of consistently low birth rate and natural population decline, the strategy of saving the population by reducing the mortality rate and increasing healthy life expectancy gains particular importance. Its urgency and relevance are indicated by Russia’s noticeable lag in these characteristics of population reproduction compared to many other countries.

In the 1960s–2000s, the predominant trend in Russia was an increasing number of deaths and crude mortality rate, caused by both the aging of the population and an increase in the intensity of mortality. The increase was particularly rapid in 1992–1994, 1999–2003. The largest number of deaths within this period was recorded in 2003, when it amounted to 2366 thousand people, or 16.4‰. After 2003, these indicators tended to decline, with small deviations from the trend. In 2019, the number of deaths registered in Russia was the lowest since 1992 at 1766 thousand people (excluding Crimea), almost a quarter less than the 2003 number (with Crimea, the number of deaths in 2019 was 1798 thousand people). The crude mortality rate decreased to 12.2‰ (12.3‰ with Crimea).

The outbreak of the COVID-19 pandemic in 2020 increased the number of deaths to almost 2139 thousand people (2022 thousand people excluding Crimea), a 19% increase compared to 2019. In 2021, the number of deaths continued to increase, exceeding not only the 2020 value (by 15% according to short-term data for January–December), but even the peak of 2003 (by 1.5%), at 2445 thousand people (2402 thousand people excluding Crimea).

The crude mortality rate increased to 14.5‰ in 2020 and to 16.8‰ in 2021. The indicator had never before reached such values in the entire period of observation since the 1960s. The previous highest points were a little over 16‰ in 2002–2003 and 2005.

The 2020 increase in all age specific death rates except for children (under 10 years) and adolescents (15–19 years old). An especially significant increase—20% or more—was observed for ages 65–85. The death rate for this group has “rolled back” to almost the level of 2010. As a result, life expectancy at birth, the indicator most often used to analyze and forecast mortality, decreased by 1.8 years, falling once again to 71.5 years, which only slightly exceeds the 2015 level. The steady growth trend that had been forming since 2004 was interrupted.

Life expectancy at birth reached its highest value for Russia, 73.3 years, in 2019. That is 8.5 years longer than in 2003, but only 3.2 years longer than the previous best recorded in 1986–1987, over thirty years ago. Thus, the increase in life expectancy observed in 2004–2019 was initially a recovery of previous positions. The landmark milestone of 70 years was exceeded for the second time in 2012. Back in the mid-1960s, life expectancy at birth in Russia approached, but did not reach that level (69.6 years according to estimates for 1964–1965). The growth trend came back only in the 1980s, when, according to data for

10Indicates the average number of years that a person from some hypothetical generation would be expected to live if throughout that generation’s lifetime the age specific death rates remained the same as in the years for which the indicator is calculated. Just as with total fertility rate, this widely used indicator has its limitations and should be supplemented by other mortality indicators [21].
1986–1987, life expectancy at birth increased to 70.1 years. However, the growth did not continue; on the contrary, it was followed by a decline, at first moderate, then sharper, down to 63.8 years in 1994. A short period of growth was once again followed by a recession (to 64.8 years in 2003), and only in 2004 did a more stable growth trend begin to form.

At the current time it is still difficult to predict how rapid will the recovery growth phase and return to previously achieved levels of life expectancy be after the COVID-19 pandemic.

Life expectancy at birth in Russia has been below the average for the developed countries throughout the entire period since the middle of the 20th century (Fig. 4).

The lag was smallest in 1960–1965, when it amounted to 1.6 years (67.9 compared to 69.5), and largest, 10.6 years, in 2000–2005 (67.1 compared to 76.9). During this period life expectancy at birth in Russia was lower compared not only to the global average (68.9), but also to the developing countries (68.7). In 2015–2020, life expectancy at birth in Russia reached the global average level (72.3 years)\(^\text{11}\) and the lag behind the average for the developed countries decreased to 7 years.

The lag behind specifically the European Union (EU-28, with the UK) was largest in 2000–2005, when it was almost 13 years (77.8 compared to 65.0 in Russia). In 2015–2020, the gap narrowed to 8.7 years (81.0 in the EU28 compared to 72.3 in Russia).

The mortality in Russia is characterized by an exceptionally large gap in life expectancy between women and men. At the highest, according to Rosstat data, level of this indicator in 2019, life expectancy at birth was 68.2 years for men and 78.2 years for women (in 2020 it was 66.5 and 76.4 respectively). The difference between women’s and men’s life expectancy at birth is about 10 years, and only several years earlier it was 13 years or more (57.4 and 71.1 in 1994, 58.9 and 72.5 in 2005). In the late 1980s, this gap was noticeably smaller at 9.6 years (1986–1988).

According to UN estimates, in 1960–1965 life expectancy at birth in Russia was almost 17 years higher than the global average (67.9 compared to 51.2 years). This difference was especially pronounced for women, amounting to 18.5 years (71.4 compared to 52.9), and less so for men, 13.5 years (63.1 compared to 49.6). However, over the next 20 years the values of these indicators in Russia remained almost the same, while globally they exhibited steady growth (Fig. 5).

In the 1990s, the life expectancy for Russian men began to lag more and more behind the global average: at first the difference was not very significant, but in 2000–2005 it reached 6.2 years (58.6 compared to 64.8). The global life expectancy for women also almost caught up to the Russian average, with the difference having decreased to 2.6 years.

In 2015–2020, life expectancy at birth for Russian women was 2.8 years higher than the global average (77.5 compared to 74.7), while for Russian men it remained 3.1 years lower than the global average (66.8 compared to 69.9).

\(^{11}\)That corresponds to the 2015–2020 average according to Rosstat data.
The most favorable trends: declining infant and child mortality. The increases in life expectancy at birth in Russia were until recently ensured mainly by declining child and infant mortality. Over the past thirty years, child mortality under the age of 5 has decreased from 21‰ in 1990 to 5.5‰ in 2020. Infant mortality, despite some fluctuations associated mainly with the transition to international live birth criteria, has also decreased: in 2020 it was 4.5‰ compared to 18–19‰ in the late 1980s and 15‰ in 2000. This was largely due to the success in reducing neonatal (within the first month after birth), primarily early neonatal (within the first 7 days after birth) mortality. There is potential for further decreasing infant mortality through reducing currently excessively high post-neonatal (within 2–12 months after birth) and late neonatal (within 8–27 days after birth) mortality rates compared to the modern trend [19, pp. 227–244].

According to UN estimates, the child mortality rate in Russia has in recent years been only slightly higher than the average for the developed countries and significantly lower than the global average (Fig. 6).

Slight progress in increasing life expectancy for older age groups. The dynamics of the death rate of the middle-aged and older population is not clear-cut: in the 1990s it increased significantly, leading to a noticeable decrease in life expectancy, especially for men. Thus, the life expectancy for 20-year-old men under the mortality rate of 1995 was about the same as 100 years ago (0.1 years less than in 1896–1897). At age 40, it was 1.6 years less, at age 60, 0.8 years less, at age 80, 1.6 years less (Table 1).

The life expectancy indicators for women of these age groups compare to the corresponding century-old values better, but at age 80 they were also lower.

Under the mortality rate of 2005, the values of this indicator improved somewhat, but not significantly.

Fig. 6. Child mortality, the world, the major groups of countries, and Russia, 1950–2020:
— Russia; --- the world; – developed countries;
-- least developed countries; -- developing countries excluding the least developed.
Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Mortality Report 2019. CD-ROM.

Table 1. Life expectancy at different ages by sex, Russia, years

| Age  | Women | Men |
|------|-------|-----|
|      | 1896–1897 | 1926–1927 | 1958–1959 | 1969–1970 | 1978–1979 | 1989 | 1995 | 2005 | 2015 | 2019 | 2020 |
| 0    | 31.7  | 45.5  | 71.5  | 73.4  | 73.1  | 74.5  | 71.6  | 72.5  | 76.7  | 78.2  | 76.4  |
| 20   | 41.4  | 47.5  | 55.9  | 55.7  | 55.4  | 56.3  | 53.5  | 53.7  | 57.5  | 58.8  | 57.0  |
| 40   | 27.4  | 32.1  | 37.3  | 36.8  | 36.5  | 37.2  | 34.9  | 35.4  | 38.8  | 39.8  | 38.1  |
| 60   | 14.2  | 17.1  | 20.1  | 19.5  | 19.4  | 19.7  | 18.5  | 19.1  | 21.5  | 22.4  | 20.9  |
| 80   | 7.4   | 6.8   | 7.7   | 6.9   | 6.8   | 6.8   | 6.4   | 6.7   | 7.6   | 8.2   | 7.4   |
| 0    | 29.4  | 40.2  | 63  | 63.2  | 61.7  | 64.2  | 58.1  | 58.9  | 65.9  | 68.2  | 66.5  |
| 20   | 40.6  | 42.5  | 47.9  | 46.0  | 44.5  | 46.6  | 40.5  | 40.4  | 46.9  | 49.0  | 47.2  |
| 40   | 26.3  | 27.3  | 30.6  | 29.3  | 28  | 29.4  | 24.7  | 24.9  | 30.0  | 31.4  | 29.5  |
| 60   | 13.9  | 14.5  | 15.9  | 14.8  | 14.4  | 14.9  | 13.1  | 13.3  | 16.0  | 16.9  | 15.2  |
| 80   | 6.9   | 5.9   | 6.5   | 5.6   | 5.4   | 5.7   | 5.3   | 5.6   | 6.7   | 7.4   | 6.2   |

Sources. Naselenie Rossii za 100 let (1897–1997). Stat. sbornik (The Population of Russia over 100 Years (1897–1997): Statistical Compendium, Moscow: State Committee for Statistics, 1998; Rosstat data.
2020, both indicators decreased, by 1.7 and 1.6 years (15.2 and 25.0), respectively.

The issue of the mortality rate of middle-aged and older Russians is especially concerning against the global background. For instance, the probability of living to the age of 60 had been increasing until the mid-1960s and then for a long time it leaned towards decreasing, especially in the 1990s, lagging increasingly behind this indicator’s values in the developed countries, and then behind the global average as well (Fig. 7). The indicator’s values in Russia began to increase only in the mid-2000s and have not reached the global average level as of yet.

Note that in current times deaths under the age of 75 are generally considered premature. Diseases and conditions leading to such deaths could have been eliminated or delayed with timely and effective intervention of the healthcare system [22]. Premature mortality exacerbates the decrease in working life [23].

In terms of life expectancy at age 60, Russia is behind not only the global average, but also the level of the developing countries excluding the least developed (Fig. 8).

In the 1950s and 1960s, life expectancy at age 60 in Russia matched and even slightly exceeded the average for the developed countries, but since the 1970s the indicator has stagnated, approaching, but never reaching 18 years. In the 1990s the values of the indicator began to decrease, and at the beginning of the 21st century, in 2000–2005, they fell to 16.2 years, below the level of mid-20th century (16.9). Since the mid-2000s, the situation has begun to improve, but so far the indicator has not reached even the global average. In 2015–2020 life expectancy at age 60 in Russia was, according to UN estimates, 19.6 years, compared to the 20.7 global average and the 23.4 average for the developed countries.

The lag behind global average values of life expectancy at age 60 is especially significant for Russian men. It has been observed since the early 1970s and in 2000–2005 increased to 4.4 years: 13.0 in Russia compared to the 17.4 global average (Fig. 9).

In subsequent years, the death rate of 60-year-old and older Russian men began to decline and life expectancy, correspondingly, began to increase, even at a faster rate than the global average. In 2015–2020, it exceeded the level of 16 years, which had never before been reached in Russia, and the lag behind the global average was reduced to 3 years (16.1 compared to 19.1 years).

In the middle of the 20th century, the life expectancy of 60-year-old Russian women exceeded the global average by more than three years. In the following years this lead gradually decreased, and in the 1990s Russia’s values began to fall behind the global average; in 2000–2005 the lag increased to 1.7 years. In recent years it has decreased to 0.2 years (in 2015–2020, 22.1 years for Russian women compared to 22.3 years for 60-year-old women globally).

High excess mortality during the COVID-19 pandemic. The COVID-19 pandemic has made the situation with mortality in Russia significantly worse.
According to the World Health Organization (WHO), Russia ranks 4th in the world in the number of deaths from the novel coronavirus infection COVID-19.\textsuperscript{12}

The number of deaths from COVID-19 in Russia in 2020 was 144.7 thousand, which corresponds to 99 people per 100 thousand resident population members\textsuperscript{13}. About 85% of COVID-19 deaths were people above working age, 45% being women above working age. The share of working-age people among COVID-19 deaths was 15%; they were predominantly men (73%).

The number of deaths from COVID-19 amounted to 6.8% of the total number of deaths, exceeding the number of deaths from external causes (6.5%), diseases of the digestive system (5.0%), and diseases of the respiratory system (4.5%). In addition, the mortality rates from most major categories of causes of death also increased, with especially significant increases in deaths from diseases of the respiratory system (by 63%), endocrine, nutritional, and metabolic diseases (25%), mental and behavioral disorders (25%), maternal mortality (24%), diseases of the nervous system (21%), and old age (20%). The mortality rate from diseases of the circulatory system increased once again as well (19%).

\textsuperscript{12}WHO Coronavirus Disease (COVID-19) Dashboard | WHO Coronavirus Disease (COVID-19) Dashboard (Date accessed: February 19, 2022).

\textsuperscript{13}Demograficheskiy ezhegodnik Rossii. 2021. Statisticheskiy sbornik (The Demographic Yearbook Of Russia. 2021), Moscow, 2021.
ing the April peak in November (40%) and December (30%). In 2021, there again were two peaks of excess mortality, but this time they were less pronounced; the first occurred in April (21%), the second in November (26%) and December (23%).

In Russia the first peak of excess mortality was slightly lower than in the EU-27, started a month later and was more long-term. In May 2020, the number of deaths exceeded the average value for the same months of 2016–2019 by 11%, in June by 12%, and in July by 18%.

After a slight decrease in August, the gap between the number of deaths and the average for 2016–2019 values began to increase rapidly, increasing to 57% in November and 50% in December. In the last three months of 2020 the deviation from the average values for the same months of 2016–2019 was 17–24 percent points higher in Russia than in the EU-27. In the first five months of 2021 the excess number of deaths in Russia compared to the average values of 2016–2019 gradually decreased. The third peak occurred only in July; but was more pronounced (44%) than in the EU-27 and was immediately followed by a more significant increase in excess mortality in October (62%) and November (77%). In December, the deviation was reduced almost in two (38%).

The excess number of deaths in Russia in January–December 2021 compared to the average for 2016–2019 amounted to 609.4 thousand people, while in 2020 it was half that number, 302.5 thousand people.

The high level of excess mortality in Russia is primarily associated with the relatively lower level of vaccination coverage. The experience of other countries shows that successfully managing the pandemic requires early response, a unified strategy for the entire country, mass testing, rapid contact tracking, standby bed capacity, and availability of on-call medical staff.[25]

Due to the excess mortality associated with the COVID-19 pandemic, in 2020 life expectancy at birth decreased not only in Russia, but also in most EU-27 countries. Slight growth continued only in Denmark and Finland (by 0.1 years for both sexes). In Latvia and Cyprus it remained at the same level as in 2019. In the other countries the decrease ranged from 0.2 years in Germany to 1.6 years in Spain, reaching or exceeding 1 year in 10 EU-27 countries.16

**Low healthy life expectancy in Russia.** According to WHO estimates calculated adjusting for the years of life lost to diseases, the healthy life expectancy (HALE) at birth in Russia in 2019 was 64.2 years. This is 0.5 years longer than the global average, but 5.6 years less than the average for the high-income group of countries according to per capita national income and 2.8 years less than the average for the upper-middle-income group (Table 2).

The estimates for Russia for 2000, 2010, and 2015 show a lag behind the global average and a more significant lag behind the high-income and upper-middle-income countries. However, in these years HALE at birth in Russia exceeded the average for the lower-middle-income group by three years or more. Russia itself moved between these categories during this period: in 2000–2003 it was classified as a lower-middle-income country, in 2004–2011 and 2015–2019 as an upper-middle-income country, and in 2012–2014 as a high-income country.

Despite a significant increase in HALE at birth (by 6.9 years over 2000–2019), in terms of this indicator Russia remains significantly behind countries with high life expectancy, such as Japan (ahead of Russia by 9.9 years in 2019), France (by 7.9), or Sweden (by 7.7). The lag behind the United States is less significant (1.9 years).

The lag in healthy life expectancy at birth is especially large for Russian men. For Russian women this indicator is lower only in comparison with high- and upper-middle-income countries; a lag behind the United States was observed in 2000, 2010, and 2015, but in 2019 Russian women’s HALE was longer.

In terms of HALE of men at the age of 60, Russia is behind not only the global average and high- and upper-middle-income countries, but even lower-middle-income countries (Table 3).

In 2019, the HALE of 60-year-old men in Russia was lower than the corresponding indicators in Japan, France, and Sweden by about 6 years, while the difference for women of the same age was 3–5 years. The gap between Russia and the United States had decreased: for 60-year-old women it had decreased by

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16Eurostat database. Life expectancy by age and sex [demo_mlexpec]. https://ec.europa.eu/eurostat/data/database. (Date accessed: January 18, 2022).
17Excess mortality—statistics—Statistics Explained (europa.eu). https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Excess_mortality_-_statistics (Date accessed: February 17, 2022).
from 2.5 years in 2000 to 0.4 years in 2019, for men of the same age, from 4.8 years to 2.8 years.

HALE estimates based on self-reported health state data show that between 2006 and 2016 the difference between Russia and the “old” European Union (EU-15) in terms of HALE at the age of 20 decreased from 16.2 to 13.4 years for men and from 12.2 to 9.7 years for women. In 2006 the HALE of 20-year-old men was 37.5 years in Russia and 37.5 years in the EU-15, in 2016 42.6 and 56.0 years, respectively; the cor-

Table 2. Healthy life expectancy at birth by sex, Russia, the world, groups of countries by income*, and individual countries, years

| Year | Russia | World | HI countries | UMI countries | LMI countries | USA | Sweden | France | Japan |
|------|--------|-------|--------------|---------------|---------------|-----|--------|--------|-------|
|      | Total population |        |              |               |               |     |        |        |       |
| 2000 | 57.3   | 58.3  | 67.7         | 62.4          | 53.8          | 65.8| 69.9   | 69.3   | 71.6  |
| 2010 | 60.5   | 61.5  | 69.3         | 65.1          | 57.5          | 66.7| 71.2   | 71.2   | 73.0  |
| 2015 | 62.7   | 62.9  | 69.6         | 66.4          | 59.0          | 66.6| 71.4   | 71.7   | 73.6  |
| 2019 | 64.2   | 63.7  | 69.8         | 67.0          | 60.0          | 66.1| 71.9   | 72.1   | 74.1  |
|      | Men    |       |              |               |               |     |        |        |       |
| 2000 | 52.4   | 57.1  | 66.1         | 60.8          | 53.3          | 64.6| 69.0   | 67.4   | 69.5  |
| 2010 | 56.2   | 60.2  | 67.9         | 63.4          | 56.7          | 65.7| 70.7   | 69.7   | 71.2  |
| 2015 | 58.8   | 61.7  | 68.4         | 64.7          | 58.4          | 65.6| 71.0   | 70.5   | 72.0  |
| 2019 | 60.7   | 62.5  | 68.7         | 65.5          | 59.3          | 65.2| 71.7   | 71.1   | 72.6  |
|      | Women  |       |              |               |               |     |        |        |       |
| 2000 | 62.8   | 59.6  | 69.3         | 64.1          | 54.3          | 67.0| 70.7   | 71.1   | 73.5  |
| 2010 | 64.9   | 62.9  | 70.6         | 66.9          | 58.3          | 67.7| 71.7   | 72.5   | 74.7  |
| 2015 | 66.5   | 64.2  | 70.8         | 68.2          | 59.7          | 67.5| 71.8   | 72.9   | 75.1  |
| 2019 | 67.5   | 64.9  | 70.9         | 68.6          | 60.6          | 67.0| 72.1   | 73.1   | 75.5  |

* HI countries—high-income countries (over 12535 US dollars per capita); UMI countries—upper-middle-income countries (4046–12535); LMI countries—lower-middle-income countries (1036–4045).
Source. GHE: Life expectancy and healthy life expectancy. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-life-expectancy-and-healthy-life-expectancy.

Table 3. Healthy life expectancy at the age of 60 by sex, Russia, the world, groups of countries by income*, and individual countries, years

| Year | Russia | World | HI countries | UMI countries | LMI countries | USA | Sweden | France | Japan |
|------|--------|-------|--------------|---------------|---------------|-----|--------|--------|-------|
|      | Total population |        |              |               |               |     |        |        |       |
| 2000 | 12.3   | 14.1  | 16.6         | 14.0          | 12.1          | 15.7| 17.4   | 18.0   | 18.7  |
| 2010 | 13.4   | 15.1  | 17.8         | 15.0          | 12.9          | 16.5| 18.3   | 19.3   | 19.7  |
| 2015 | 14.4   | 15.5  | 18.0         | 15.7          | 13.3          | 16.5| 18.5   | 19.5   | 20.0  |
| 2019 | 15.0   | 15.8  | 18.2         | 16.0          | 13.5          | 16.4| 18.9   | 19.7   | 20.4  |
|      | Men    |       |              |               |               |     |        |        |       |
| 2000 | 9.9    | 13.1  | 15.2         | 13.0          | 11.5          | 14.7| 16.3   | 16.3   | 16.7  |
| 2010 | 11.0   | 14.1  | 16.5         | 13.9          | 12.3          | 15.6| 17.5   | 17.9   | 17.8  |
| 2015 | 12.1   | 14.6  | 16.8         | 14.5          | 12.8          | 15.7| 17.8   | 18.2   | 18.4  |
| 2019 | 12.8   | 14.8  | 17.1         | 14.9          | 13.0          | 15.6| 18.3   | 18.5   | 18.8  |
|      | Women  |       |              |               |               |     |        |        |       |
| 2000 | 14.0   | 15.1  | 17.9         | 15.0          | 12.6          | 16.6| 18.4   | 19.5   | 20.5  |
| 2010 | 15.2   | 16.1  | 18.9         | 16.0          | 13.5          | 17.2| 19.0   | 20.6   | 21.3  |
| 2015 | 16.1   | 16.5  | 19.0         | 16.7          | 13.8          | 17.3| 19.1   | 20.7   | 21.5  |
| 2019 | 16.7   | 16.6  | 19.2         | 17.0          | 14.0          | 17.1| 19.4   | 20.8   | 21.9  |

* See the Table 2 note.
Source. See Table 2.
responding indicators for 20-year-old women were 44.2 and 56.5 years in 2006 and 48.8 and 58.8 years in 2016 [19, pp. 220–223].

Conclusions. Analysis of the dynamics of the population of Russia and key characteristics of its reproduction against global trends has shown that in terms of a number of demographic characteristics Russia is quite similar to the developed countries. Consistently low birth rate that cannot ensure simple generation renewal inevitably leads to aging of the population, a slowdown of population growth, and ultimately to natural population decline. Global trends such as aging of the population and increasing demographic load on the working-age population are modified in Russia by the specifics of the age structure of its population, which has been significantly deformed by demographic waves.

The challenges of ensuring social protection, reducing social differentiation, and maintaining a strong foundation for reproductive plans of the population require a sustainable and long-term system of social support measures for families with children. Forecast calculations show that even a relatively small but steady increase in the birth rate can significantly impact the future size of the population and its age structure.

Russia’s lag in life expectancy behind the average values of the developed countries, and in some characteristics even from the global average, is a cause for serious concern. Insufficient progress in reducing the mortality rate in middle and older ages, especially in men, significantly increases population loss due to natural decline and deforms the sex structure of the population. The lag in healthy life expectancy indicates serious problems both with self-preservation behavior of the population and with the functioning of the healthcare system.

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