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# ANALYSIS OF MORTALITY IN YAKUTIAN POPULATION FROM 1960 TO 2010

**ABSTRACT**

The dynamic of the Yakutia population mortality for period from 1960 to 2010 is presented in this article. The article shows the main periods of mortality dynamics, analyzes the main causes of mortality and gives the forecast of Yakutia mortality indicators by 2030 taking into account the pace of economic development and human well-being.

**Keywords:** mortality, causes of mortality, demographic processes, Yakutia.

In the modern Russia the mortality rate is one of the most actual medical and demographic problems. The Republic of Sakha (Yakutia) is one of the largest regions of the Russian Federation, holds 1/6 part of the country and refers to areas with harsh climatic conditions, low population density. In the Far North the human organism is affected by a whole range of climatic, geophysical and environmental factors. These factors directly or indirectly influence on the demographic processes that have adverse effects on human health, deplete adaptive reserves of the human organism, leading to the emergence of diseases, changing their course, and contribute to premature aging and shortened life expectancy.

With the development of the North and the intensive development of the mining industry since the early 1970s to Yakutia was characterized by constant population growth, mainly due to the massive influx of working-age population from outside the republic and the natural population growth. However, as a result of social-economic and political changes in the country observed an outflow of population from the republic.

In this connection, it will be interesting to analyze the Far North population mortality for half a century from 1960 to 2010 in comparison with those of the Russia as a whole. The study is based on the official statistics of mortality of the Russian Federation and the Republic of Sakha (Yakutia) Federal State Statistics Service for the period 1960-2010.

In the dynamics of Yakutia mortality can distinguish several periods (Fig. 1).

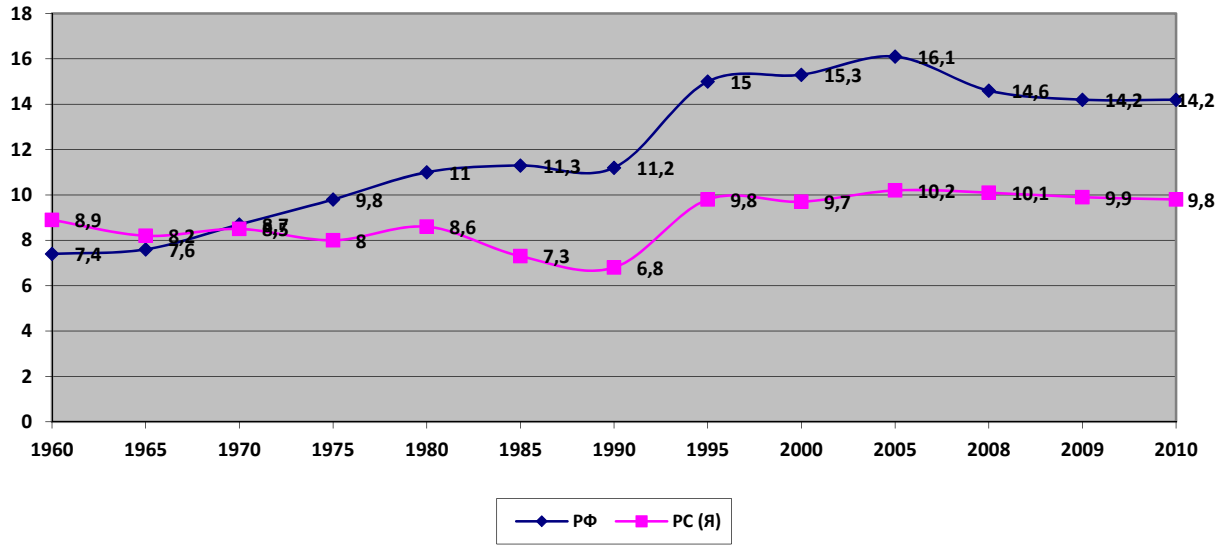



Fig. 1. **Dynamics of mortality in the Russian Federation and the Republic of Sakha (Yakutia) (number of deaths per 1000 population)**

**The first period** (1960-1980) – is a period of declining mortality with individual and short-term increase. Until to 1970 the mortality rate of the republic was superior to that of the average for the USSR, which is explained by the low standards of living in the North, an unsatisfactory level of medical care attributed to low [5]. Since the early 1970s the situation has changed – mortality in Yakutia decreased in comparison with average indicators in the USSR, explained by a change in the age structure of the Yakutian population. During this period, due to the rapid industrial development of the Northern territory there was a constant increase in the number of economically active young people coming from outside of Yakutia. Over the years, new towns and villages were built. Thus, between 1960 to 1980 the population of Yakutia grew by almost 1.5 times and continued to grow until 1991, when the total population reached its highest level in the history of the republic republic – 1 million 119 thousand people (Fig. 2). During this period, the average mortality rate decreased by 0.2% per year and reached 8.6% in 1980 (compared to 11.0% in the USSR).

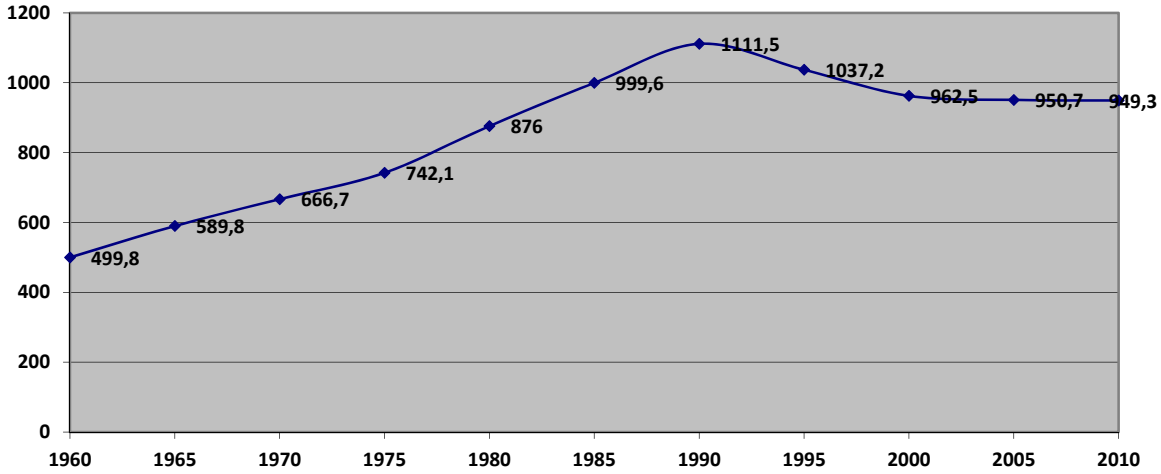



Fig. 2. **Population Dynamics of Yakutia (thousands of people)**

**The second period** (1980-1989) was characterized by stable and more significant decrease of mortality rate (3.2% on average per year) [1]. But it was short-lived. The dramatic decline in mortality began in 1985. The minimum rate of mortality was observed in republic in 1987 and amounted to 5.9‰. This period corresponds to the beginning of the reforms carried out by M.S. Gorbachev, two years occurred in the anti-alcohol campaign.

**The third period** (from the beginning of 1990s.) is characterized by the increase in level of mortality among republic population [3, 4, 11]. As a result of the influence of social-economic and political changes in the country began to leave the working population outside the country, the population of the republic acquired a pronounced tendency to decrease gradually. The maximum values of out-migration were observed in 1991-1994 and by 1995 the overall mortality rate exceeded the 1987 figure by 66% and was equal to about 9.8‰ [13].

Furthermore, since 1996 there has been some re-reduction in total mortality, and in 1998 it amounted to 8.9% of reaching the mortality rate in 1960 [2]. During these years the economy recorded positive shifts. The Government is taking a series of effective measures to maintain financial stability in the country, keeping the ruble within reasonable limits and fighting inflation. But in 1998 when the financial crisis broke out in the country, the mortality rate for the year increased by 8% (from 8.9 to 9.6‰).

The mortality rate in the Republic between 2001-2008 was stable at 10.2‰ and only after 2009 it starts to reduce [1, 6, 7-10, 12].

**Analysis of the major causes** of death show the following changes (table 1). Before the migration processes, the leading causes of mortality were accidents, injuries and poisonings, followed by tumors and the then, diseases of the circulatory system. However, since the mid 1960s the main cause of death was cardiovascular diseases (also in Russia overall). Death from external causes shifted to second place, and then.

**Analysis of the main causes** of the Yakutia population mortality in the dynamics showed the following changes (Table 1). Before to the migration processes in the structure of the republic population mortality the leading accidents, injuries and poisoning, in second place – tumors and the third – diseases of the circulatory system. However, since the mid 1960s the main cause of the population death began to cardiovascular diseases, as well as in the whole of the Russia. A mortality rate due to external causes has shifted to the second place, and tumors occupied a stable third position.

**Table 1.**

**Mortality by main causes of death in dynamics from 1960 to 2010 in Russian Federation and Republic of Sakha (Yakutia) (number of deaths per 100 thousand population)**

| Years | 1959 / 1960 | 1964 / 1965 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|
| | The coefficient of total mortality | | | | | | | |
| **RF** | 762,3 | 694,2 | 1130 | 1120 | 1497,7 | 1529 | 1609,9 | 1419,2 |
| **RS (Y)** | 901,5 | 859,2 | 726,7 | 669,8 | 979,7 | 971,4 | 1020,3 | 981,2 |
| **Including deaths from circulatory diseases** | | | | | | | | |
| **RF** | 187,9 | 194 | 633,9 | 617,4 | 790,7 | 846,1 | 908 | 805,9 |
| **RS (Y)** | 112,1 | 229 | 244,9 | 228,9 | 341,8 | 381,7 | 466,8 | 469,5 |
| **from tumors** | | | | | | | | |
| **RF** | 118,9 | 124,4 | 172,9 | 191,8 | 203 | 204,7 | 201,2 | 205,1 |
| **RS (Y)** | 138,4 | 131,2 | 114 | 122 | 130,5 | 132,6 | 126,3 | 120,7 |
| **accidents, injuries and poisonings** | | | | | | | | |
| **RF** | 69,3 | 77,3 | 137,6 | 133,7 | 236,8 | 219 | 220,7 | 151,7 |
| **RS (Y)** | 150,3 | 180,2 | 178,4 | 164,6 | 257,7 | 243,9 | 230 | 195,4 |
| **respiratory diseases** | | | | | | | | |
| **RF** | 99 | 68,8 | 79,5 | 59,3 | 73,9 | 70,3 | 66,2 | 52,3 |
| **RS (Y)** | 108,3 | 86,2 | 65,7 | 40,8 | 51,3 | 43,3 | 36,4 | 34,9 |
| **from diseases of the digestive system** | | | | | | | | |
| **RF** | 34,7 | 24,7 | 30,3 | 28,7 | 46,1 | 44,4 | 65,5 | 64,4 |
| **RS (Y)** | 45,2 | 30,9 | 33,4 | 26,1 | 55,5 | 45,8 | 46,3 | 55,7 |
| **from infectious and parasitic diseases** | | | | | | | | |
| **RF** | 66,2 | 37,6 | 17,2 | 12,1 | 20,7 | 24,9 | 27,2 | 23,5 |
| **RS (Y)** | 15,2 | 87,9 | 27,6 | 14 | 20,4 | 15,2 | 15,4 | 11,4 |

During the period from 1960 to 1990 in the structure of mortality decreased mortality from cancer by 12%, respiratory diseases – 2.5 times , diseases of the digestive system – 42%, and from infectious and parasitic diseases – by 8%. Mortality from cardiovascular diseases has increased in 2 times (from 112.1 to 228.9 per 100 thousand populations). According to the Russian Federation for the period mortality of cardiovascular diseases increased by 3.2 times (from 176.9 to 617.4). Deaths from accidents, poisonings and injuries among population of Yakutia have increased by 9.5% (in Russia by 93%). However, deaths from these causes have always exceeded the figure for the Russian Federation. So, in the early 1960s death rate from accidents, injuries and poisoning in the republic amounted to 150.3 per 100 thousand inhabitants (the Russian Federation – 69.3). Its highest level this figure reached in the early 1980s and in 1995 (251.7 and 257.7 deaths per 100 thousand pers.).

In 1990-2010 the growth rate of total mortality of the republic population exceeded the rate of growth in the Russian Federation. Thus, from 1990 to 2005 the mortality rate in Yakutia has increased in 1,5 times ( in Russia by 1.4 times), reaching a high of 10.2 per 1,000 population, mainly due to causes such as circulatory system diseases –in 2 times and 40 % - from accidents, injuries and poisonings. Then, after the adoption by the Government National Project "Health", since 2006 in the dynamics of the population mortality observed reduction in major mortality. During the period of implementation of the "Health" project from 2005 to 2010 total mortality decreased by 3.8% in the country (according to the Russian Federation – 11.9%), mainly due to the reduction in mortality from external causes – by 15% (in Russia – 31%), infectious and parasitic diseases – by 26% (in Russia – by 13.6%), from cancer – by 4%. However, there is an increase two times in mortality from diseases of the digestive organs.

With regard to mortality from diseases of the circulatory system, it is overcome in the country is much slower than in the whole of Russia. If in Russia during this period there is a decrease in mortality from these reasons, this figure is not the downward trend in the country. Thus, the rate of increase in mortality from diseases of the circulatory system in the Republic of Sakha (Yakutia) in the period from 1990 to 2010. They were 3.5 times higher than Russia.

Between 1960-1990 in Yakutia the mortality rate decreased by 25.7%. This period was characterized by a large influx of people of working-age, due to the industrial development of the Northern territories of Yakutia. The total population increased by 2.3 times. However, it changed the ranking of the causes of death. In place of such "traditional" causes of death such as respiratory diseases, diseases of the digestive system, tumors, and infectious and parasitic diseases came new diseases, mainly those of the circulatory system. During this period, deaths from circulatory diseases in Yakutia increased two-fold.

The available statistical sources show the age structure of the population being dominated by people of working age and children as compared with the RF (table 2). Until 1995, children accounted for almost one-third of the total population, and by contrast, people above working age accounted for only about 9%, with the rest of the population being of working age.

Table 2.

**The share of age groups in the general population of the Russian Federation and the Republic of Sakha (Yakutia), %**

| Years | 1979 | 1989 | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| *Younger working age (men and women 0-15 yr)* | | | | | | |
| RF | **23,3** | **24,5** | **22,7** | **19,4** | **16,3** | **16,1** |
| RS(Y) | **31,8** | **32,6** | **30,2** | **27,5** | **24,2** | **23,3** |
| *In the working-age (men 16-59,women16-54 yr)* | | | | | | |
| RF | **60,4** | **57** | **57,0** | **60,2** | **63,3** | **62,3** |
| RS(Y) | **62** | **61** | **60,6** | **62,6** | **65,2** | **64,1** |
| *Above working age (men 60 and more, women 55 and more)* | | | | | | |
| RF | **16,3** | **18,5** | **20,3** | **20,4** | **20,4** | **21,6** |
| RS(Y) | **6,2** | **6,4** | **9,2** | **9,9** | **10,6** | **12,6** |

During the period 2005-2010 the total mortality rate in the Republic decreased by 3.8% (11.9% in Russia), mainly due to a 15% reduction in mortality from external causes (31% in Russia), infectious and parasitic diseases by 26% (13.6% in Russia). However, there is a doubling of mortality from diseases of the digestive system.

As for mortality from diseases of the circulatory system, the increase in the mortality rate in the Republic between 1990-2010 was 3.5 times higher than in Russia as a whole.

**Discussion:**

While the majority of the republic population are young, and the highest rates of mortality are within older age groups, the overall mortality rate was low compared to the average. However, the true picture is not so good. If the population structure of Russia is taken as standard, then the standardized mortality is higher than the actual, and that for the whole of the Russian Federation (table 3).

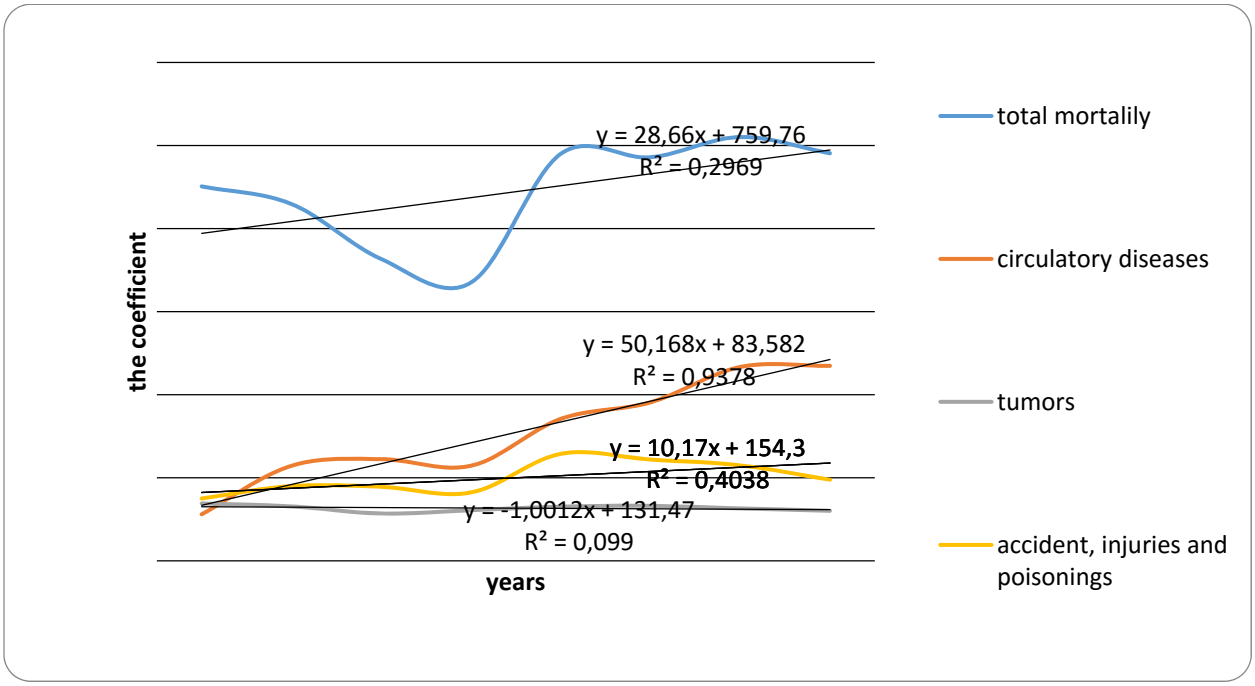
**Table 3.**

**Standardised mortality rates from all causes of death in the Russian Federation and the Republic of Sakha (Yakutia) (number of deaths per 1,000 populations)**

| Years | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| RF | **15,0** | **14,9** | **13,9** | **13,1** | **12,9** | **12,3** | **12,3** |
| RS(Y) | **15,7** | **15,5** | **14,3** | **14,4** | **14,4** | **13,7** | **13,6** |

During the last 20 years (1990-2010) the mortality rate increased by 46.5%. This is explained by an outflow of young people, with a consequent decline in the population by 15%. During this period, the age structure of the population changed in favour of people of working age or older, whose numbers increased by 1.5 times, while the absolute number of children decreased by 1.6 times. Overall, the working-age population fell by 10%. Thus, in the republic, as well as in Russia, there was a trend of population ageing. A linear trend in mortality rates indicates that total mortality from diseases of the circulatory system has not had a tendency to decrease.

Linear trend in mortality shows that the total mortality rate of the population, as well as diseases of the circulatory system does not tend to decrease (Fig. 3).




Y - the equationofthe trend linechart

R2 - value ofthe reliability ofapproximation

**Fig. 3.** Trends of main indicators of mortality among population of Republic of Sakha (Yakutia) in the dynamics from 1960 to 2010

According to forecasts by the Federal State Statistics Service, based on an assessment of the resident population of subjects in Russia by sex and age on January 1 2009, and subject to the Concept of Demographic Policy of the Russian Federation for the period up to 2025, the overall mortality rate of the population will depend on the pace of economic development and increasing well-being of Russian citizens.

Analysis of the dynamics of mortality in the Sakha Republic (Yakutia) is the basis for an evaluation of possible future scenarios (Fig. 4).

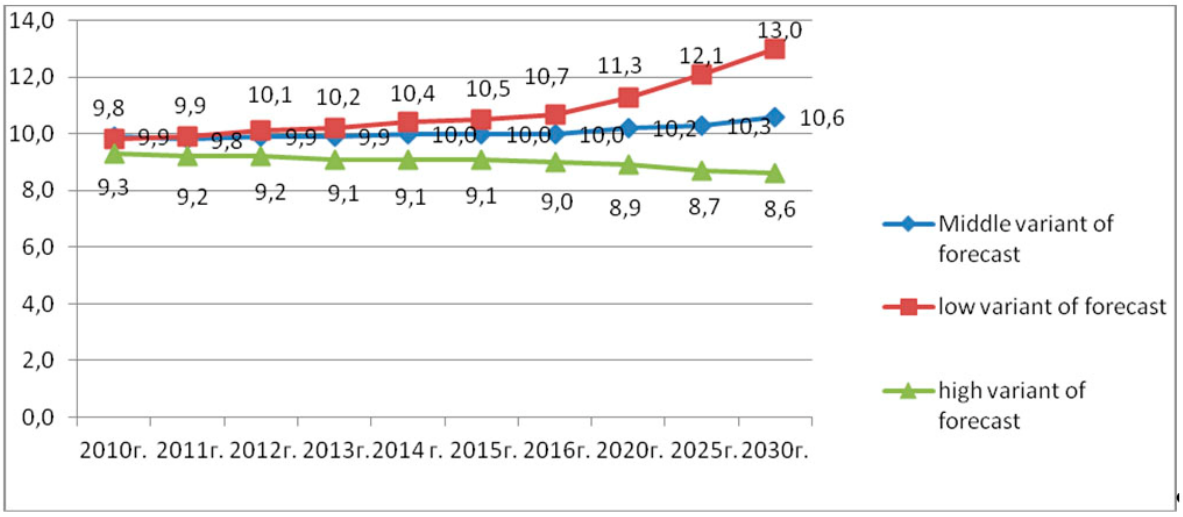



**Fig. 4.** Forecast the overall mortality rate of the Yakutia population (number of deaths per 1000 population)

A low (pessimistic) scenario considers the deterioration of the socio-economic climate, and results in mortality rates in the Sakha republic (Yakutia) increasing by 1.4 times to reach 13.0 cases per 1000 population by 2030. The middle scenario assumes a slower development of the country so that the mortality rate will remain at a consistently high level. A high (optimistic) scenario, assumes an improving socio-economic situation in Russia, and that the measures designed to reduce mortality identified in the Concept of Demographic Policy of the Russian Federation until 2025, and the priority national project "Health" are successful. This results in a reduction in the mortality rate to 7.5% by 2030.

**In cconclusions,** mortality is the best recorded and the most informative indicator of the state and dynamics of public health. It is no less useful than other public health indicators, and proves to be very sensitive both to the political reforms in the country and to the state of social and economic conditions. Changes in mortality reflect the number and age structure of the population, which in turn reflects changing migration patterns. Due to the increase in the working age population there was a decrease in mortality within the republic, and subsequently a decrease in the working age population increased mortality rates. During this period there was a change in the rank structure of mortality. In place of such "traditional" causes of death as respiratory diseases, digestive system, tumors, infectious and parasitic diseases have come new, mainly diseases of the circulatory system. Mortality from cardiovascular diseases in the republic increased by 4 times. The long-term forecast of population mortality rate depends on the pace of economic development and well-being of Russian citizens.

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