Factors and Specifics of Increased Life Expectancy in the Republic of Sakha (Yakutia)

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Abstract. The article studies problems and specifics of the mortality in the Republic of Sakha (Yakutia). The mortality causes in Yakutia were analysed in terms of territory and gender. After mortality coefficients were standardised, it was established that the North regions of the Republic have higher mortality rate among younger people. Mortality decrease and increased life expectancy potential were analysed. The mortality analysis identified high mortality rate among males, in particular due to external reasons. It has been established that Group 1 causes represent the majority of all preventable causes of death that include injuries and poisoning and also causes associated with unhealthy habits. The contribution of individual causes of death into the loss of life capacity in the Republic was identified with the majority of them being external ones. The conducted analysis of the estimated life expectancy indicates positive trends.

1. Introduction

The average estimated life expectancy is not only an integral indicator of mortality and life quality of the population, but also an intrinsic part of human development. Increased life expectancy is the key goal of the national project Demography. The studies showed that the estimated life expectancy was influenced by the following meaningful factors: low salaries, social and economic instability, high level of society criminalisation, unhealthy habits and lifestyle. The estimated life expectancy is directly influenced by the mortality rate. Increased mortality rate in Yakutia in the 1990s led to lower life expectancy [1]. Researchers believe that one of the reasons of low estimated life expectancy in Russia is associated with high mortality rate from external causes [2].

2. Mortality and life expectancy in the Republic of Sakha (Yakutia)

By the end of the 20th century the gap between Russia and other developed countries in terms of life expectancy, in particular among males, had become the same or even bigger than in the beginning of the 20th century, when Russia had been a backward agrarian country [3].

Life expectancy in the Republic is still lower than in Russia (Figure 1). In 2000, the indicator in the Republic was 63.66 years, while in Russia it was 65.37 years. Into 2017 the gap between the indicators for the Republic and Russia grew and reached 2.61 years. Life expectancy of males and females in Yakutia and Russia are also different. For example the life expectancy among males in the Republic was 66.39 years and 77.07 among females, while in 2017 in Russia it was 67.51 and 77.64 years for men and women respectively.

Table 1. Estimated life expectancy (number of years).

	2000	2005	2010	2013	2014	2015	2016	2017	The Russian Federation (2017)
Both sexes	63.66	64.68	66.75	69.13	69.81	70.29	70.84	70.09	72.70
Males	57.90	58.66	60.97	63.54	64.34	64.94	65.78	66.39	67.51
Females	70.27	71.54	73.13	75.00	75.50	75.84	75.98	77.07	77.64

Source: Source: Territorial authority of the Federal Statistics Office in the Republic of Sakha (Yakutia).

In Yakutia as a whole there are positive trends is the estimated life expectancy. Decreased mortality influenced the growth of the average life expectancy of the population. Four example, if in 2000 it was 63.66 years, for both sexes, in 2017 the life expectancy grew up to 72.7 years, in other words by more than nine years. The life expectancy among women is higher than among men. However, the gap is closing. For example, in 2000 it was about 13 years, but today it has decreased up to 10 years. In 1990 the estimated life expectancy in the Republic was 66.9 years, with 62.5 for men and with 71.5 for women. We must say that these indicators are below the average ones for Russia, to say nothing of the developed countries.

"Working-age population for many decades has been the key group that determines The life expectancy Russia" [4]. The share of the deceased in working age among all the people who died in 2000 was 46.5%, and it have been slowly decreasing since 2011. Today there is a significant gap between Men and women. The number of deceased working age men in the analysed period is by two or more times higher than that of women (Figure 2).

Table 2. Percentage of working age people in the total number of the deceased, %.

	2000	2005	2010	2011	2012	2013	2014	2015	2016
Total	46.5	48.2	46.9	45.5	43.2	41.4	40.2	38.7	37.5
Males	59.1	61.1	60.6	58.3	57.4	55.6	53.8	52.5	50.5
Females	26.3	26.7	25.0	25.0	21.5	20.3	20.2	18.7	19.3

Source: Demographical Annual Journal of the Republic of Sakha (Yakutia), 2017

Some industrial areas as well as the North traditional villages account for the highest share of those who died in their working age. As we have already said, the percentage of women who died in their working age is significantly lower than that of men. How ever, in some areas the percentage of deceased women is similar to that of men.

The standardisation of mortality coefficients allows to eliminate the influence of the age structure of the population. The direct standardisation method helped to calculate standardised mortality coefficients for every area, with the age structure of the population of The Republic of Sakha (Yakutia) taken as a baseline. The areas are grouped by the size of the general and standardised mortality coefficient, and this allows to monitor the differences in the mortality rate, which are determined by the age structure of the population.

Territorial distribution of standardised mortality coefficient is shown in Figure 1. The lowest standardised mortality coefficients are found in Allaikhovsky and Churapchinsky regions and in the city of Yakutsk. Mirninsky, Oleneksky, Tattinsky, Neryungrinsky and Amginsky regions have a lower coefficients then the average for the Republic. Ust-Yansky, Oimyakonsky, Srednekolymsky and Abyisky regions, in other words in the North regions in their majority, are characterised by the highest mortality coefficients, which shows that more people die young in these regions. The total mortality

rate in these regions is determined by the demographic structure with the majority of old people, due to a big share of older people.

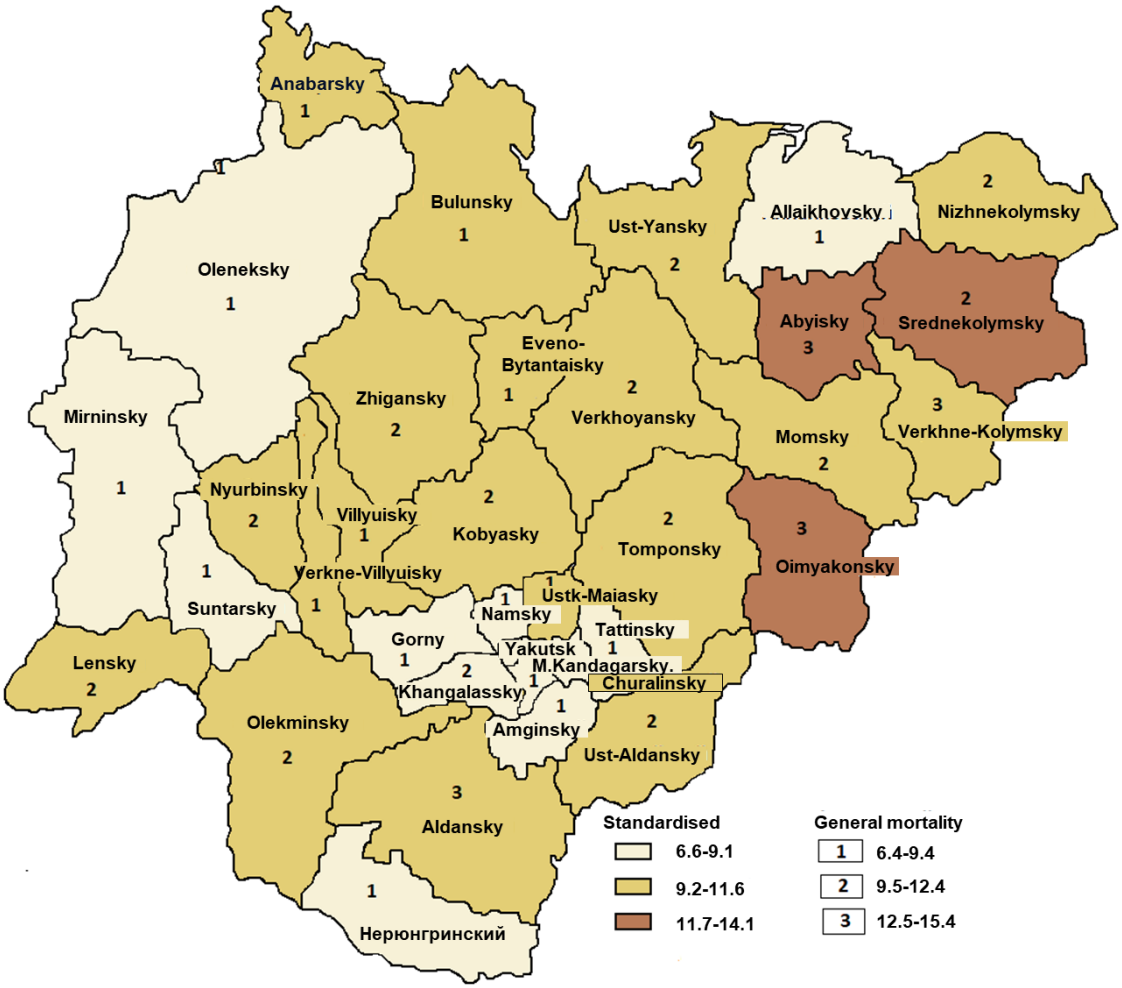

Figure 1. Regions of the Republic of Sakha (Yakutia) by the standardised and general mortality coefficient, 2016.

The main mortality causes in the Republic of Sakha (Yakutia) are circulatory illnesses, external causes and new growths. For example, in 2000 the maximum mortality of 661.5‰ from circulatory diseased was recorded in the Aldansk village, and in Ust-Maisky village with 654.1‰. The minimum mortality rate was recorded in Oleneksky village with 121.1‰. In the Republic on average it equaled 381.7 for 100,000 people. In 2014 the minimum was recorded in Anabarsk illage with 265.1 for 100,000 people, and the maximum in the Oimyakon village with 831.4 by 100,000 people. During the analysed period the highest mortality rate from circulatory diseases was recorded in 2010 in Verknekolymsk village (1114.1 for 100,000 people), with the minimum recorded in 2000 in Oleneksky village (121.1)(Figure 2).

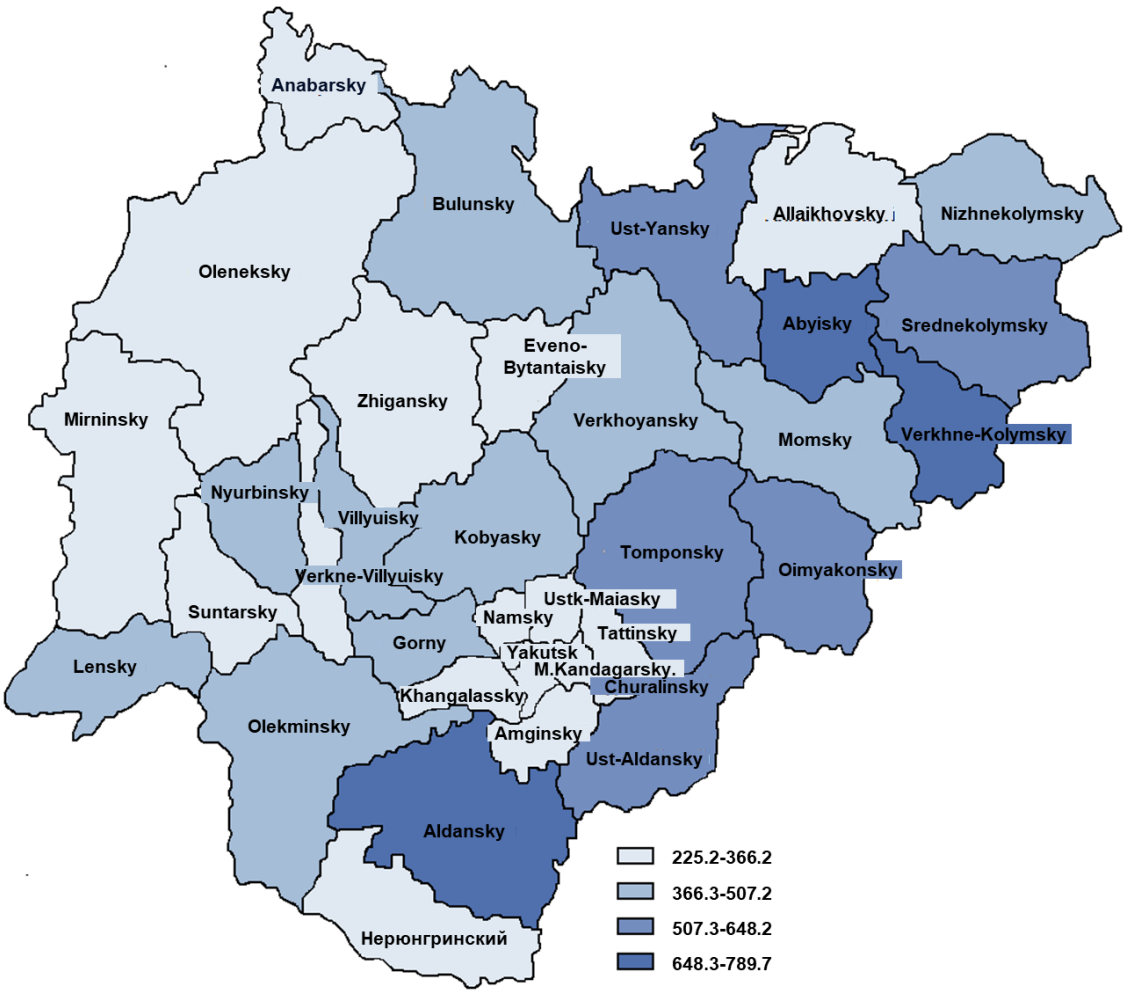

Figure 2. Mortality rate due to circulatory diseases in the Republic of Sakha, Yakutia, in 2016 by 100,000 people.

The second most common cause of death is associated with external forces. In 2000 the mortality rate from external causes was 243.9, and in 2014 it was 155.0 by 100,000 people, in other words the rate is slowing down. In 2000 the maximum mortality of 511,1‰ from this cause was recorded in the Anabarsk village, while the minimum was found in the Tomponsk village with 75.7‰, and in 2014 and the minimum was recorded in the Mirninsk village (94.3), and the maximum was registered in the Allaikhovsky village with 403.4. High mortality from external causes does not differ by gender or age, but varies from territory to territory. In the Republic of Sakha (Yakutia) Mortality from external causes in the North and Arctic regions is almost 2 times higher than the similar average mortality indicator in the Republic [5]. We must say that in a number of Arctic villages the mortality from external causes accounts for the majority of deaths. For example, in the Anabrsk, Abyisk regions the mortality from external causes was higher than from circulatory diseases (Figure 3).

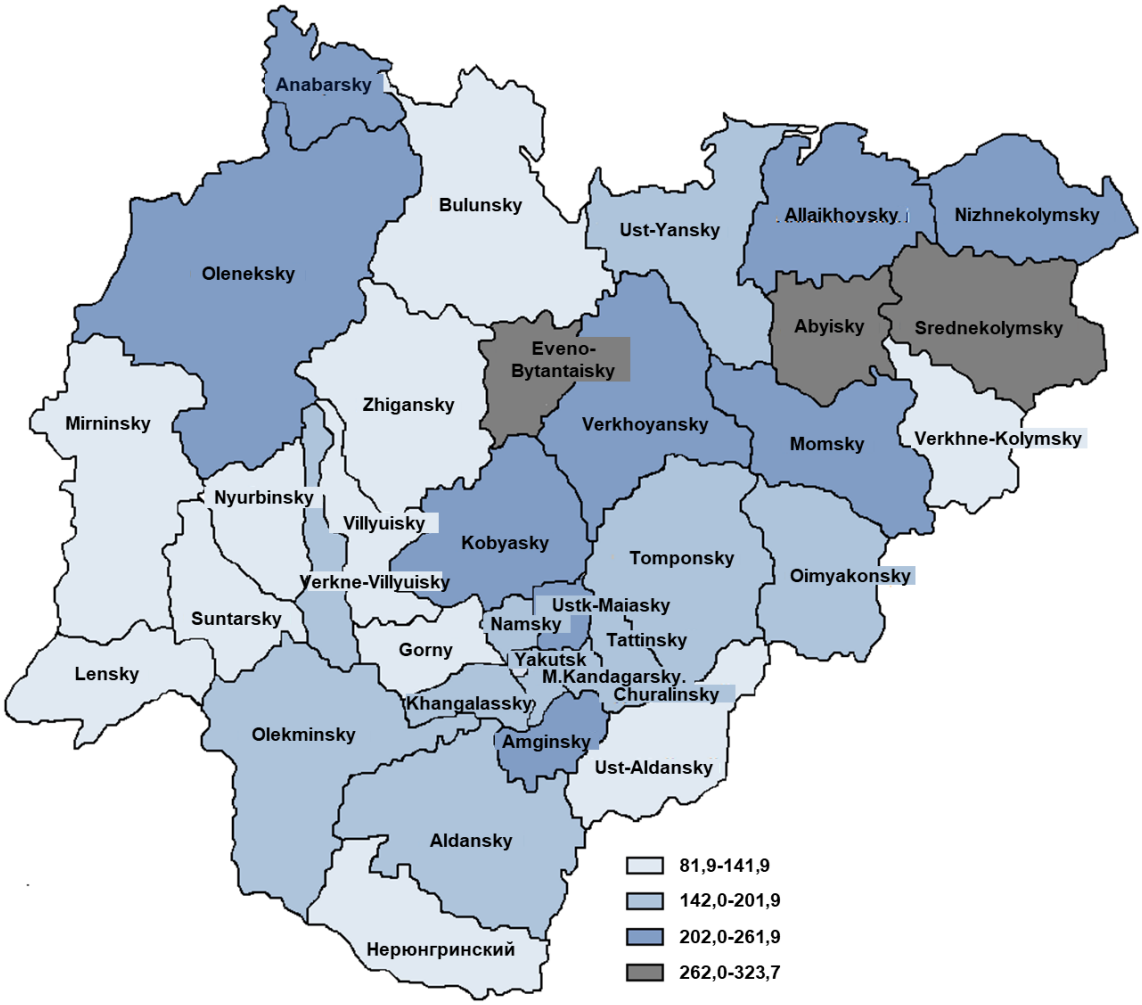

Figure 3. Mortality from external causes in the Republic of Sakha, Yakutia, in 2016 by 100,000 people.

External mortality causes are also found in other countries, both in developed and developing ones. For example in China the mortality rate among men from external causes in 1991-1999 was 72.3, while for women it was 44.4 by 100,000 people [6], while in 2000 in the Republic it was 403.6 and 89.5 respectively. High premature mortality It Is also caused with the unhealthy lifestyle of the population in the north regions [7].

Finally, the last mortality cause is associated with new growths. For example in 2000 the maximum of 205.5‰, was found in the Aldansky village, and the minimum of 53.8‰ in the Allaikhosky village. In 2014 the minimum mortality from cancer was 32.5 by 100,000 people in the Vilyuisky village, and the maximum of 249.5 was registered in the Ustk-Maisky village. However in some regions are an exception, with the mortality from cancer being the second biggest mortality cause. For example, in 2014 the mortality from cancer was higher than from external causes in the Aldansk, Gorny, Lensky, Neryungrinsky, Srednekolymsky, Tomponsky, Ust-Maisky villages and in the city of Yakutsk (Figure 4).

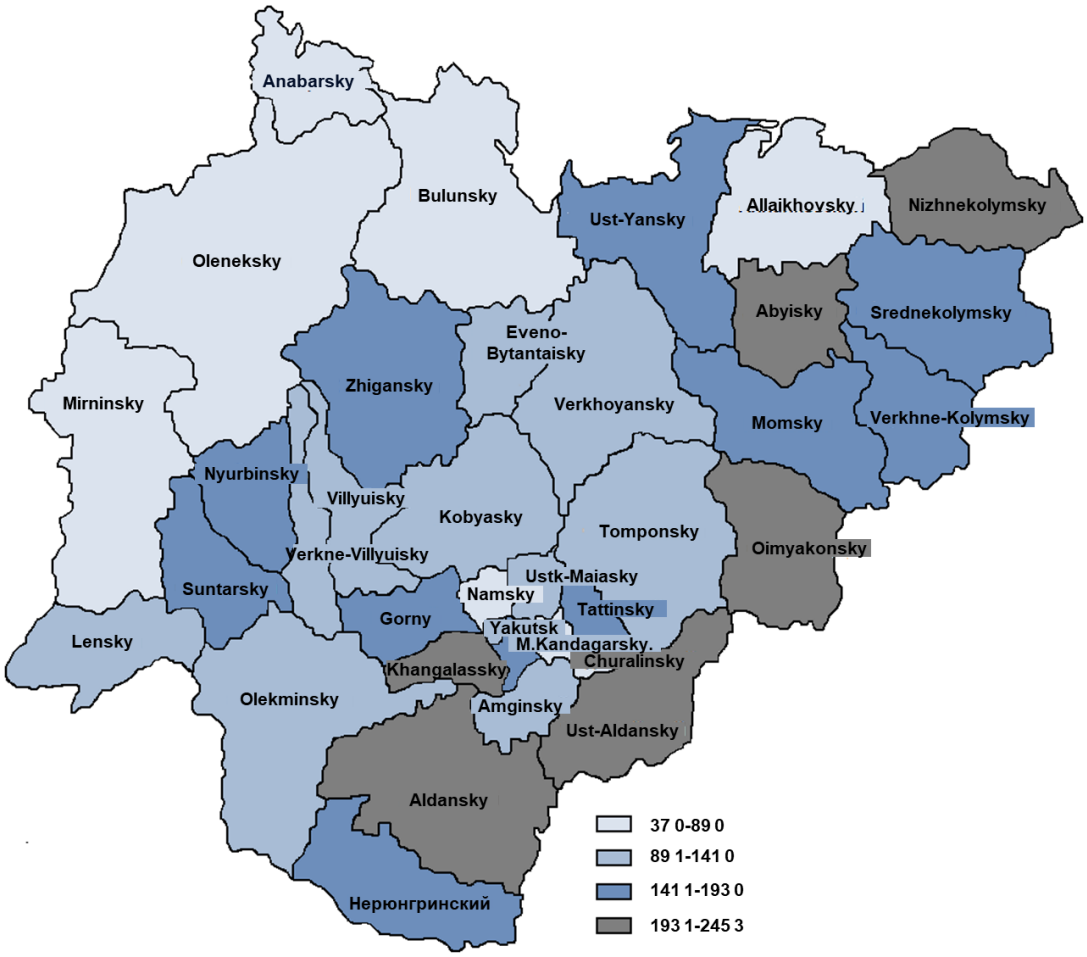

Figure 4. Mortality from cancer in the Republic of Sakha, Yakutia, in 2016 by 100,000 people.

The circulatory diseases accounted for more than 50% of the mortality in 2016 in the Mirninsky, Tomponsky, Verknekolymsky, Gorny, Aldansky, Bulunsky and Zhigansky areas. However, the circulatory diseases account for no more than 35% of the mortality in the Eveno-Bytantaisky, Oleneksky, Suntarsky and Hangalssky areas.

Allaikhovsky, Amginsky, Anabarsky, Oleneksky and Eveno-Bantyisky villages have the highest mortality from external causes with more than 25% of the total mortality. On the contrary, Ust-Maisky, Bulunsky, Verknekolymsky, Lensky, Neryungrinsky, Suntarksky, Aldansky, Nyurbinsky, Olekminsky, Oimyakonsky have the lowest mortality from external causes with less than 15%.

In 2016 in the Allaikhovsky, Oleneksky and Bulunsky areas the mortality from cancer was less than 10% of the total mortality. Cancer accounts for more than 20% of mortality in the Nizhnekolymsky, Tattinsky and Khangalassky villages.

There are significant differences in the causes of death among men and women. Circulatory diseases are the main cause of death for both men and women. At the same time for women the second biggest cause of death is cancer, while for men it is external causes (accidents, poisoning, injuries, murders and suicides).

In Yakutia the number of deaths of men from external reasons was significantly bigger than in the Russian Federation and the Far Eastern federal district both in 2002 and in 2015. The rate changed in the similar way both in Russia, in the Far East and in Yakutia. However, the percentage of external causes in the total mortality in the Republic, has unfortunately reduced the least.

An extremely high mortality rate among men is one of the negative factors that influence the general mortality rate, e.g. high mortality among men, most of them at the working age, from accidents, poisoning and injuries that are mostly associated with alcoholism. Higher mortality rate among males in comparison to the one among females was almost unchanged in 2000-2016. The highest gap is recorded in the younger age group. The "super mortality" among men from external causes is even more pronounced (Figure 3).

Table 3. Super mortality index among men (the male mortality coefficient is higher than that for females, number of times).

	2000	2005	2010	2011	2012	2013	2014	2015
Total mortality coefficient	1.66	1.75	1.69	1.68	1.61	1.57	1.57	1.55
Mortality from external causes	4.51	4.77	4.08	4.53	4.55	4.41	4.57	4.57

Mortality from external causes is special as it is almost fully determined by social factors. What is more, this cause of death is responsible for the super mortality among men. Mortality from external causes in all developed countries is the third most common cause of death after circulatory diseases and cancer. In Yakutia it comes second, and among men in 1990-1995 it was even the first most common cause of death. Violent deaths are especially common among young men aged 15-29. Violent premature deaths in these age groups account for more than 80% of all deaths. If the general male mortality is higher than the female one by 1.68 times, the number of deaths from accidents, injuries, poisoning, murders and suicides is bigger by 4.17. It is clear that the fluctuations in the rate in 15 years show bleak trends.

Sadly, the mortality rate in Russia is very different from that in developed countries. "The USA with the population that is by 2.2 times bigger than in Russia, in 2012 less people died from external causes in Russia (190,000 against 194,000 in Russia)" [9]. Suicides and murders account for the majority of violent deaths with 47% of the total number of the diseased from external causes (2015). A similar situation was found by previous researchers [10]. In 2000-2015 the mortality rate from suicides grew by 1.4 times. The number of deaths from murders, however, seems to slow down by 1.2 times. Also, the number of deaths from accidental alcohol poisoning reduced by 1.5 times as well. The most positive trends are observed in the mortality caused by traffic accidents (it has reduced by more than 2.5 times). Almost 25% of the total mortality from external causes account for suicides that are now the first most common cause of death after traffic accidents.

Deaths from external causes are most widespread among working age population (Table 4).

Table 4. Mortality rate coefficients among working age population by causes of death in the Republic of Sakha (Yakutia) by 100,000 working age people.

Mortality causes	2000	2005	2010	2015	2016
All causes	732.9	773.6	725.5	552.8	524.2
Some contagious and parasitic diseases	18.6	17.5	12.5	14.1	17.0
Cancer	78.4	79.0	64.2	63.3	65.7
Circulatory diseases	193.2	264.2	260.3	188.6	176.2
Accidents, poisoning and injuries	324.2	291.7	252.9	192.2	181.4
Of which:					
Suicides	68.9	67.0	56.1	49.6	45.0
Attacks (murders)	74.8	70.5	47.7	30.5	28.5

External causes are the second most common cause of death after circulatory diseases and account for more than 17% of all the deaths. In 1990-2015 the number of the diseased reduced by 24.2%. However, unfortunately, the death coefficients remained almost at the level of 1990. What is more, in a number of Arctic regions of the Republic these causes become the most common ones [8].

Males account for 60% of the mortality among working age people. Male mortality rate is still higher than the female one, in particular in the working age group [11]. About one quarter of all the women were in their working age when they died. External causes account for the majority of deaths of the population in general.

The share of individual external causes of death varies by regions. The least gap between the death coefficients in Russia and in the Far East is registered in the number of deaths caused by alcohol poisoning and traffic injuries.

The classification of preventable causes of death by WHO [12] states that the 1 group causes account for the majority of the preventable causes of death. However, if in 2010 these causes accounted for almost 83% of all preventable causes, in 2015 the share reduced to a bit more than 76%. Despite a small contribution of the 2nd group causes into all the preventable causes of death, their share is growing from 2 to 3.61%. The 3rd group causes are influenced by the healthcare and medical services quality are also becoming more common and now are responsible for more than 20% of deaths (Table 5).

Table 5. Preventable causes of death in the Republic of Sakha (Yakutia), %.

	2010	2015
Total	100.0	100.0
1 group	82.61	76.24
2 group	2.07	3.61
3 group	15.32	20.15

Thus, in the Republic of Sakha (Yakutia) external causes of death are as important as circulatory diseases in terms of fighting the reduction of the demographic potential. The analysis of the regional differences in the mortality rate from external causes shows that the demographic potential faces significant losses due to these causes in particular. The analysis of the mortality from external causes once again demonstrates that not all the aspects of health and mortality are determined by the healthcare system and relevant preventive measures.

3. Loss of the life potential in the Republic of Sakha (Yakutia)

The analysis of the life potential losses is an important step in the research of the mortality issues that allows to assess the capacities for reducing the mortality rate and increasing the life expectancy. The size of the life potential depends on the level of age mortality and number of people in the relevant age groups [13].

As a whole, the life potential decreases both for men and women [14]. In 1990 the majority of the life potential losses of both men and women were associated with circulatory diseases. External causes were the second most common ones among men, and the third ones among women. 39.8% of men and 22.5% of women died of external causes, which can be explained by the high mortality rate from these causes among young active people [15]. The analysis of the mortality rate in terms of the causes of death, shows the lack of a consistent trend that determines the relevance of further research of the life potential losses in the region.

The negative trend of considerable losses of the life potential in the Far Eastern regions has been continuing for some time now. "As a rule, the worse the life potential loss group, the higher the percentage of the Far Eastern regions..." [16].

The losses of the life potential in the regions are reducing. However, the losses associated with external causes have grown. Korobitsyn with his co-authors [17] have established that in 2010 in

comparison to other Far Eastern regions, the Republic of Sakha (Yakutia) was the first region in terms of the potential life losses of men from external causes, and the third one in the case of females.

Similar to other north regions, the mortality rate in the Republic of Sakha (Yakutia) is "the main indicator for economic successes and errors" [18] and has a number of negative consequences [19]. External causes are the second most common cause of death after circulatory diseases and account for more than 17% of all the deaths. Male mortality rate is still higher than the female one, in particular in the working age group [20]. About one quarter of all the women were in their working age when they died.

The authors calculated the life potential losses in 2015-2017. The life potential losses are based on the calculation of the number of years that have not been lived before a potentially possible age; and they are also an indicator of the population's health. This indicator was calculated using the following formula:

$$PYLL = a_i(d_i/P_i)(P_{ir}/\sum P_{ir}) * 1000 \quad (1)$$

where a_i is the difference between the limit age (here we assumed it to be 75 years) and the mid-point of the age interval, d_i is the number of the diseased in the *i* age group, P_i is the population size in the *i* age group, and P_{ir} is the standard population size.

Women older than 70 years account for the majority of the losses of the life potential. The biggest number of deaths is registered among men aged 50-64 years. At the same time, the number women at the same age group is significantly lower and does not exceed 16.5 person years. For example, in 2017 the losses of life potential at the 50-54 age group are 27.3 person years. Also, we must say the first increase in the male life losses was recorded among young working age men aged 25-29.

In 2015-2017 life losses among working age males on average were higher than among women by 3.5 . Losses among men and women in senior age groups are almost identical, and male mortality in the younger age group is slightly higher than the female one (Table 6).

Table 6. Life potential losses in the Republic of Sakha (Yakutia) in 2015-2017, person years.

Age gap	2015		2016		2017	
	Males	Females	Males	Females	Males	Females
Under the working age	10.89	7.24	16.66	10.16	10.07	6.16
Working age	143.26	39.32	151.80	57.22	152.36	35.05
Over the working age	49.80	49.62	56.90	61.38	47.70	47.56
Total	203.9	96.2	229.0	129.9	210.1	88.8

Circulatory diseases account for the greatest loss of life potential in comparison to other causes of death. For example, in 2017 the losses amounted to 56.4 person years. We must say that life losses associated with these causes of death are higher among the working age group than among the elderly. The life losses from external causes are about 27.5 person years and reach their maximum in the 40-44 age group with 4.8. Then there is cancer that accounts for 20.6 person years in life potential losses and amounts to the maximum of 4.2 person years in the 50-54 age group. As a whole, the life potential losses from all causes among the working age group are two times higher than among the elderly (Table 7).

Such information is very important for the development of regional programmes that are designed to impact the essential and most manageable factors determining the mortality rate, including specific causes of death on the regional level [21].

Table 7. Life potential losses in 2017, person years.

	Contagious diseases	Cancer	Circulatory diseases	Respiratory illnesses	Diseases of the digestive tract	External causes of death	All causes
Under the working age	0.1	0.3	0.2	0.9	0.1	2.3	8.0
Working age	3.26	10.92	28.54	2.46	6.06	37.12	95.60
Over the working age	0.3	9.3	22.2	1.6	1.8	2.4	42.8
Total	3.2	20.6	56.4	5.1	7.1	27.5	157.9

4. Conclusions

In conclusion, the situation associated with the mortality rate in the Republic of Sakha (Yakutia) can be characterised as unfavourable. Despite the decrease of the general indicator and the absolute number of deaths, the mortality rate grows among individual age groups. The mortality among the working age group remains high. In terms of mortality there is a significant gap between men and women. Exogenous causes account for the majority of all the causes of death, and, as a whole, allow to find a favourable opportunity to influence the mortality rate.

We can also say that lower life expectancy in the Republic of Sakha (Yakutia) in comparison to the Russian Federation is a result of two major factors that determine the high mortality rate. First, the number of deaths caused by circulatory diseases is growing, unlike developed countries. Second, the super mortality from accidents, poisoning, injuries, murders and suicides, in particular among working age men, also increases and is the leading cause that prevents the life expectancy from growing.

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